January 1983
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- Commodore 64
- Ada Compilers
- Apple Graphics Utilities
- Speedread +
- E-Z Learner
- Amdek RGB Monitor
- 13 Apple Games
- Aeronaut
- Cypher Bowl
- Ceemac
- Krazy Antiks

How to do 3-D Stereo Graphics

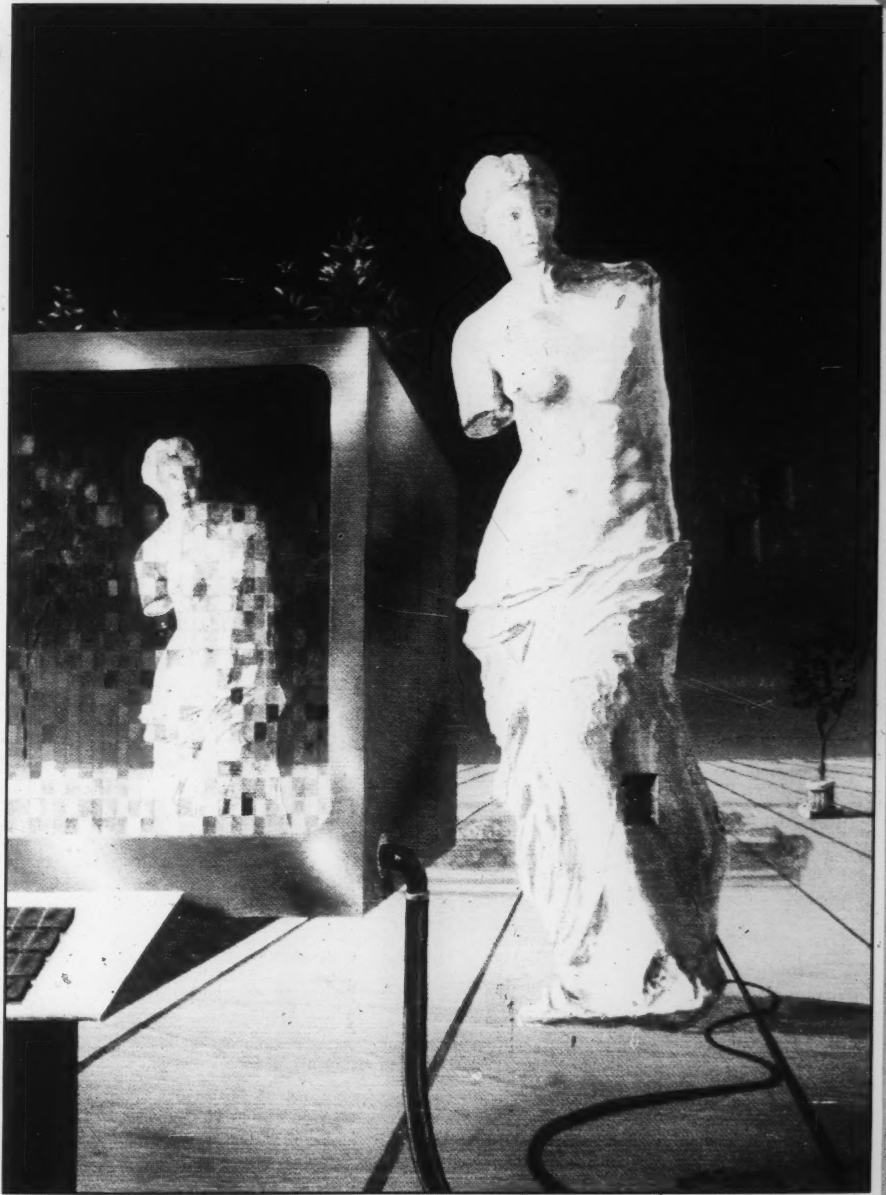
MX-80 Graphics With Pascal

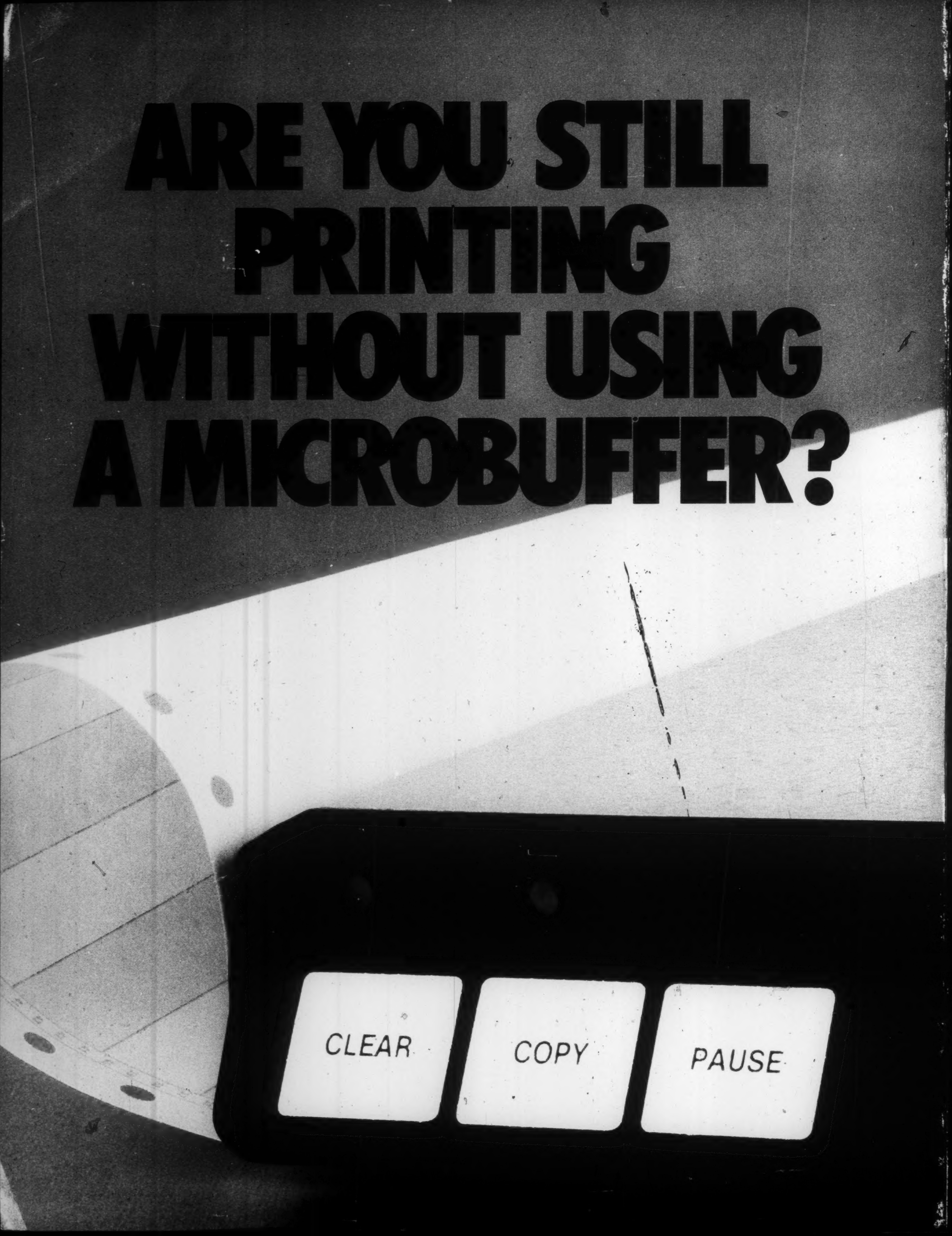
TRS-80 Graphics Made Easy

Is Computer Art Really Art?

IBM Character Generator

Brainwarp— A Game for the VIC-20

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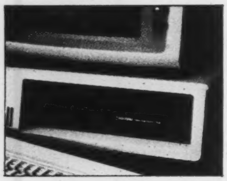

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in this issue...

evaluations & profiles

8 **The Franklin Ace 1000**...*Carpenter*
An Apple work-alike for home or office

21 **The Commodore 64**...*Jeffries*
Just a 40-column Vic?

30 **The Amdek Color II**...*Hockenhull*
A high-resolution RGB monitor

39 **Apple Graphics Utilities**...*Murphy*
Graphics Magician and Graphics Processing System

46 **Two Ada Compilers**...*Gilpin*
A comparative review

54 **Ceemac**...*Jackson*
A structured graphics language for the Apple

59 **Speedread+**...*Stolker*
Improve your reading speed

64 **E-Z Learner**...*Murphy*
A program to help you memorize facts

68 **Avalanche Of Apple Games**...*Ahl, Jacobs, Rost & Vogeli*

94 **Eamon**...*Plamondon*
An extensive, inexpensive adventure series

104 **Aeronaut**...*Cashman*
Flying high with TI

110 **Gridiron Action And Antiks**...*Hixson & Leemon*
Two Atari games for long winter nights

articles

116 **The Personal Computer World Show**...*Kewney*
Dragons, Acorns and other micro-innovations

120 **Telephones, Toilets, And Car Parks**...*Staples*
Random observations on life in England

123 **Microcomputer Chess Tournament**...*Harrington*

132 **Logo Ideas**...*Lawler*

136 **When is Computer Art Art?**...*Mueller*
A dissenting view

146 **Pixel Averaging**...*Cook*
Smooth graphics and effects

January, 1983
Volume 9, Number 1

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applications & software

162 **Stereo Graphics**...*Fowler*
Three-dimensional effects for personal computers

192 **Computer Art For The Tektronix 4052**...*Jacobson*
Programming polar coordinate curves

202 **Three Ways Of Looking At A Function**...*Fuller*

214 **Linked Lists**...*Coleman*
They're alive and well in computer graphics

224 **MX-80 Graphics From Pascal**...*Dousette*

234 **An IBM Character Generator**...*Fan*
Customized characters for special purposes

238 **TRS-80 Graphics Made Almost Painless**...*Crew*

250 **Colorful Circles**...*Foxx*
Filling and coloring Apple circles

258 **Programming Wheels**...*Hastings*
Useful subroutines for the IBM PC

266 **Picture Zapper**...*Tenney*
Eliminate black holes and Venetian blinds

268 **Draw Art**...*Pitzel*

270 **8 x 8 Create**...*Spahitz*
A Vic character Generator

274 **Why We Really Buy Creative**...*Gunther*

279 **Brain Warp**...*Scroggin*
A cube program for the Vic

departments

6 **Dateline: Tomorrow**...*Ahl*
News and Views

26 **Seven Years Ago**...*Ahl*
As we were

282 **New Products**...*Anderson*

290 **The Graph Paper**...*Lubar*
Part seven: Scrolls and other creatures

302 **Apple Cart**...*Coffey*

306 **Outpost: Atari**...*Anderson*
Upstart Atari

312 **IBM Images**...*Fastie*
Personal finance programs

324 **The Other Side**...*Kewney*

326 **Personal Electronic Transactions**...*Clifton*
64 sprites explained

332 **TRS-80 Strings**...*Gray*

350 **Index To Advertisers**...

Cover illustration by Michael Carroll.

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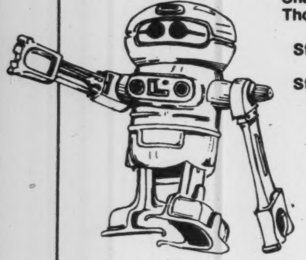

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Creative Computing
Ziff-Davis Publishing Company
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New York, NY 10016
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Advertising Coordinator
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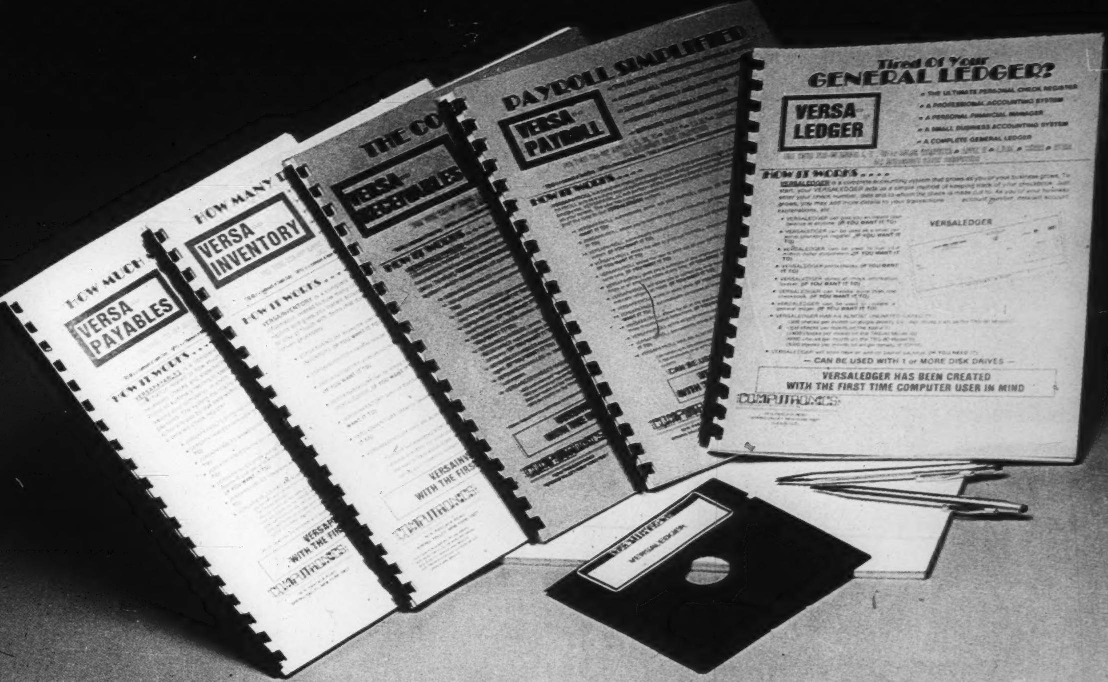

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CIRCLE 146 ON READER SERVICE CARD

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David H. Ahl

An IBM Home Computer?

With demand for the IBM Personal Computer (PC) still far exceeding supply even though the company is turning out 15,000 machines a month, can IBM be eying the home market? It seems likely.

This January for the first time, IBM plans to exhibit at the Consumer Electronics Show. Interestingly, Apple and Radio Shack have both shunned CES of late, perhaps feeling that the video games image would hurt their sales to business and professional customers. But IBM is leaping into the CES arena with a large booth in a prime location.

At $3,500 plus, the current IBM PC is not a serious contender in the truly home market, hence, it is reasonable to expect a new low-ended unit at the show. While IBM is being tightlipped as usual, at least three market researchers (Future Computing, Dataquest and the Yankee Group) also expect a lower performance computer from IBM in 1983.

Pac-Man on the Move

With bus ridership on the decline, Daniel Prins, president of Jefferson Lines, Inc. was willing to try some innovative tactics. Jefferson serves north-south routes from Minneapolis to New Orleans and hits places like Little Rock, Houston, Kansas City and Ames, Iowa. Most buses are not completely full, so Prins pulled the rear seats and replaced them with Pac-Man games.

"People just love it," Mr. Prins said. Ridership is holding up, and Jefferson is doing just fine against Greyhound and Trailways.

Prins is obviously concerned about deregulation, pricing and route structures. But he pays attention to less momentous decisions, too. "Right now I am grappling with the question of whether to continue with Pac-Man on the buses, or take my six-year-old son's advice and go with Donkey Kong. It's these really big issues that get you down."

Commodore MAX to Compete with Timex/Sinclair?

Jack Trameil, CEO of Commodore, said the company will introduce a home computer "in the $99 range" in 1983. "Timex/Sinclair has broken the $100 barrier, and we'll be there, too." Trameil gave no details, but one might expect that the announced but not released 2K MAX video game/computer might be offered for $99 instead of the originally planned $179.

Commodore also announced that production of the VIC-20 will be moved to West Chester, PA because of increased volumes of both the VIC-20 and 64. VIC-20 production will be increased from 2,000 to 3,000 per day, while production of the 64 in Santa Clara is being increased to 10,000 a month.

New Atari Computer

In a low-key announcement about shifting some computer production to Hong Kong and Taiwan, Atari mentioned that production of a new computer will begin in the second quarter of 1983. Variously known by code names such as Sweet 16, 64 and Atari 600, the new machine is reported to be an updated version of the Atari 400 with a standard, full-stroke keyboard.

Video & Arcade Games Magazine to Debut

Amid an already crowded field of entries, Creative Computing will introduce a new magazine, Video & Arcade Games, in January 1983. Differentiating itself from the other me-too entries, it will have more than twice the editorial material of any other magazine and will cover four major areas: arcade games, home video games, computer games and electronic games. It will also carry in-depth reviews of games instead of the press releases carried by some other magazines. Initially, 250,000 copies will be distributed to newsstands; subscriptions may be available later.

Creative Computing Software Bows Out

With the increased emphasis on magazine and book publishing, Creative Computing has elected to bow out of the software business. The debut of Video & Arcade Games, increasing the frequency of three other magazines from bi-monthly to monthly, and a dramatically stepped up book publishing program will require all of our resources and attention. Hence, we felt we could not continue to be a leader in the software business, too.

Software orders will continue to be filled if inventory is on hand. We are currently making arrangements with other software publishers to take over the line; watch these pages for an announcement about future availability of Creative Computing Software.

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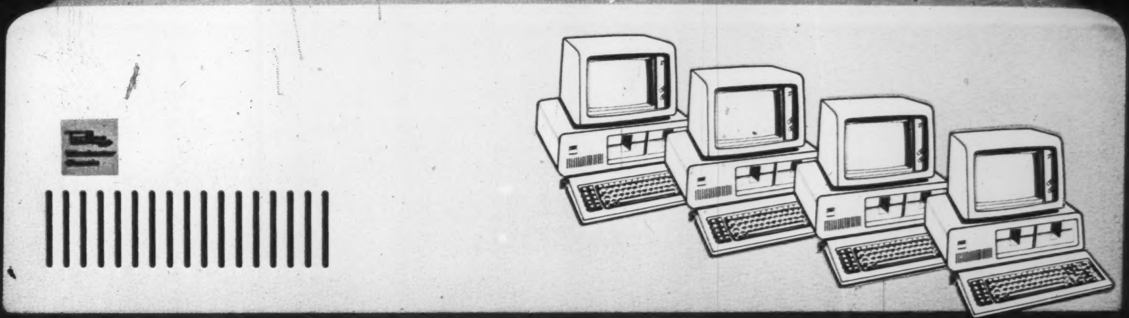

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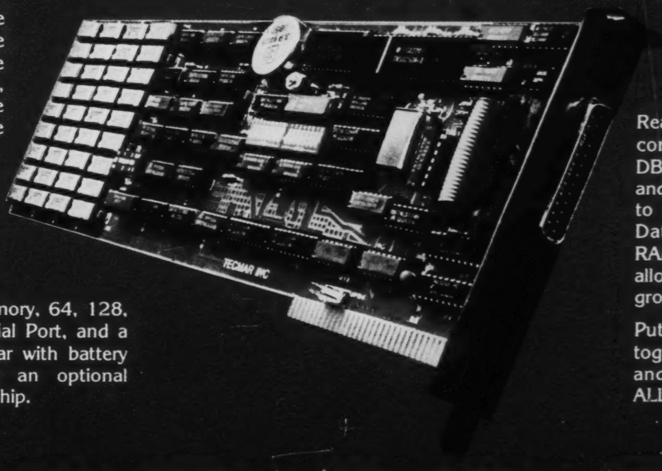

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CIRCLE 352 ON READER SERVICE CARD

Apple Work-Alike

Chuck Carpenter

Having one personal computer that will do most everything I want to do has always seemed highly unlikely. That is, until I tried the Franklin Ace 1000, an Apple work-alike computer from the Franklin Corporation.

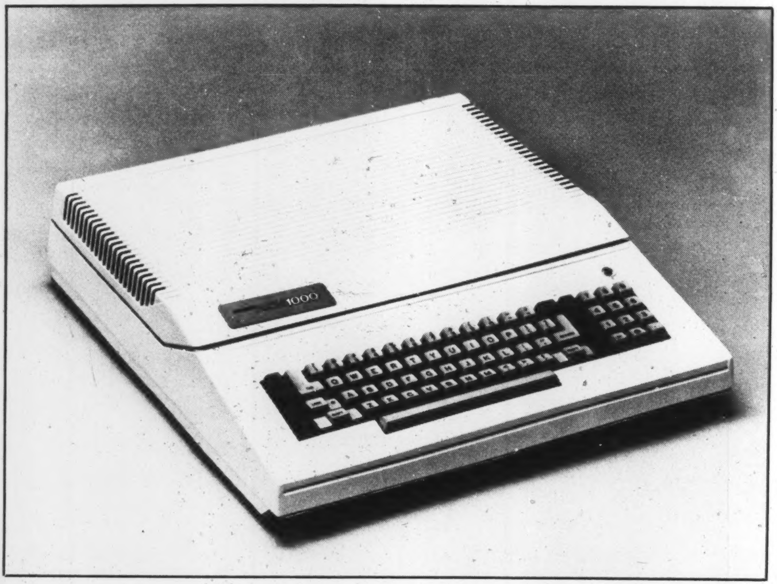
By simply including a standardized, full size ASCII keyboard, the Ace 1000 comes close to meeting all my requirements, primary among which is word processing. Others include communications, hardware testing, and software development for business purposes (test, measurement and control, not accounting or inventory). Let's take a closer look at the Ace 1000; perhaps it will meet your requirements, too.

Features

One of the first things you notice is the size of the Ace 1000 assembly. Some of this added size is width necessary to accommodate the length of the full size keyboard. Inside, extra space is needed for the large power supply and the spacious main circuit board.

Extra space on the circuit board means more room between components and between cards in the expansion slots. With more room between parts, cooling is improved and heat related problems are less likely to occur.

Additionally, the power supply has a built-in fan, which is noisy but not



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CIRCLE 192 ON READER SERVICE CARD

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6502 at 1.022 MHz

Text
40 characters x 24 lines standard
5x7 upper/lower case
Direct lower case entry
Normal, Inverse, Flash

Graphics
Black and White only
40 horizontal x 192 vertical
40 vertical with 4 text lines

Hi-Res Graphics (B&W)
280 horizontal x 192 vertical
160 vertical with 4 text lines

Cost
$1530 Processor
$ 579 Drive and Controller
$ 479 Drive without Controller

EME/RFI
FCC Class A Service
Class B pending

Memory
64K bytes of RAM
250 ns access time
6 EPROM sockets (2716)

Keyboard
72 keys upper/lower case
15 key Visicalc pad
2 special function keys

I/O
Joystick/paddle connectors
8 expansion slots

Physical
17¾" x 4½" x 19¾"
15 pounds

Power
115 VAC, 60 Hz, 65 watts

Table 1.

objectionably so. Besides keeping the power supply cool, the fan circulates air inside the computer case to aid in component cooling.

Table 1 shows the published specifications of the Ace 1000. In using the system, I have listed some additional features which should be of interest to prospective purchasers and users.

Most significant is the full-size keyboard. It includes a sculptured design to aid the user, and the layout of the keys is similar to an IBM Selectric. All the key functions worked properly with the languages and programs I tried.

Keys on the keyboard are individually replaceable. Manufactured by Keytronics, the keyboard uses capacitive switches so there are no contacts to wear out. The "feel" is somewhat spongy with a certain amount of tactile feedback to the user. I am used to a keyboard like this so it didn't bother me.

All keys on the keyboard are repeat keys. Consider how much help this feature is when using a word processor. Text editing involving extended cursor movement is greatly improved, for instance.

Two special keys called PAUSE and BREAK are included on the keyboard. These are especially useful in Basic and Pascal programming. PAUSE generates a CTRL-S and BREAK generates a CTRL-C.

Memory for the equivalent of a 16K RAM expansion card is included on the main circuit board. Slot 0 is not needed for this application. A cut-and-jumper area is included to allow you to use slot 0 if you need to.

Cassette capability is not included with the Ace 1000. However, space for the circuit components is included in the circuit board etch (see Figure 1). I suspected that some of the Ace 1000 features used the memory space originally occupied by the cassette input/output (I/O) routines, and on investigation this turned out to be the case. Therefore, the cassette routines are not available in the firmware. Because the Ace 1000 is not considered a hobby machine, the cassette interface was not included.

Booting with the Ace 1000 Master Disk allows you to enter Floating Point Basic in lower-case. (Similar to Basic-80 under CP/M.) When you list a program the lower-case commands and statements are converted to upper-case. Any variables entered in lower-case remain in lower-case. Under control of the Ace 1000 Master Disk, a lower-case filename is saved in upper-case. Integer Basic is converted directly to upper-case as you type.

When you boot with an Apple II Master Disk, you can enter Floating Point Basic in lower-case but not disk operating system (DOS) commands. Also you can't save a program using a lower-case filename. For Integer Basic you must press the shift lock key and enter everything in upper-case.

Otherwise, the operation and functions of the Franklin Ace 1000 are the same as the Apple II. A few minor problems arise because of the differences in keyboards. These will be discussed in more detail later. Table 2 is a summary comparison of Ace 1000 and Apple II features.

Hardware

Generally, the hardware is much like that of the Apple II. Power supply capacity is greater — about 65 watts for the Ace 1000 and 40 for the Apple II. Memory expansion (16K) is built-

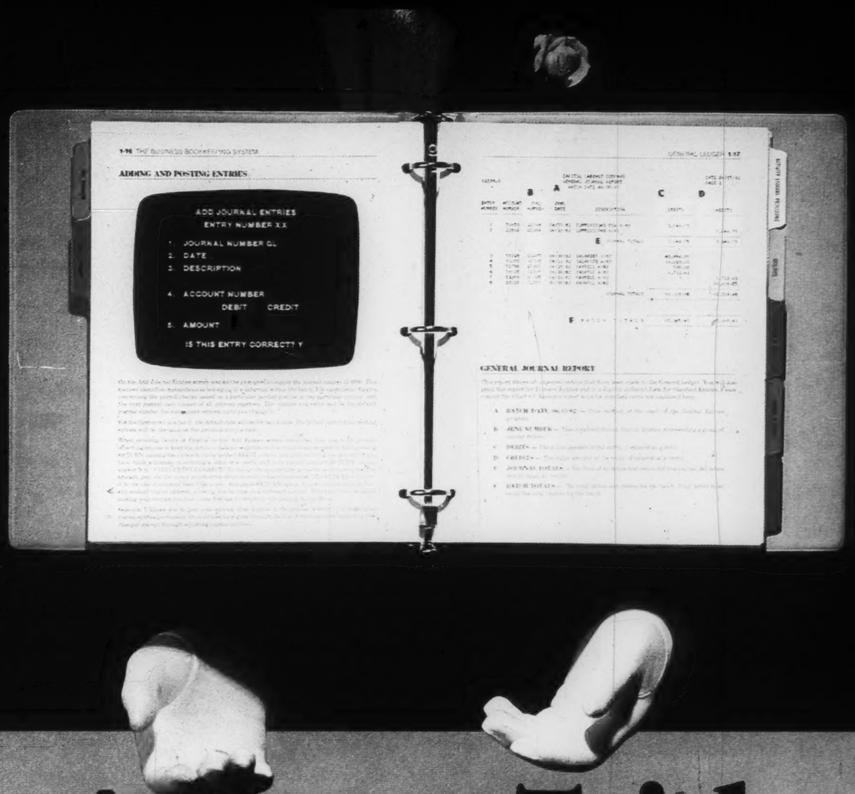
Franklin Ace 1000 Comparison

Item Supplied	Apple II	Ace 1000
Full upper/lowercase keyboard	No	Yes
Cassette interface	Yes	No[1]
Color graphics	Yes	No
Black and white graphics	Yes	Yes
Visicalc 15-key keypad	No	Yes
80-Character columns[2]	No	No
Power supply with fan	No	Yes
64K RAM memory[3]	No	Yes
Mini-assembler[4]	Yes	Yes
Floating Point routines[4]	Yes	Yes
Sweet-16 interpreter[4]	Yes	Yes
Programmer's aid routines[4]	Yes	Yes

(1) Circuitry of components included on the main circuit board.
(2) Videoterm or equivalent board suggested.
(3) 16K equivalent expansion board built-in to Ace 1000 main circuit board.
(4) Available with soft-loaded Integer Basic or Integer Basic ROM card.

Note: A ROM card or memory expansion card can be used in slot 0 if appropriate cuts-and-jumpers are added to the selection block area of the main circuit board.

Table 2.



1-16 THE BUSINESS BOOKKEEPING SYSTEM

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```
ADD JOURNAL ENTRIES
ENTRY NUMBER XX

1.  JOURNAL NUMBER GL
2.  DATE
3.  DESCRIPTION

4.  ACCOUNT NUMBER
           DEBIT     CREDIT
5.  AMOUNT

IS THIS ENTRY CORRECT? Y
```

GENERAL LEDGER 1-17

GENERAL JOURNAL REPORT

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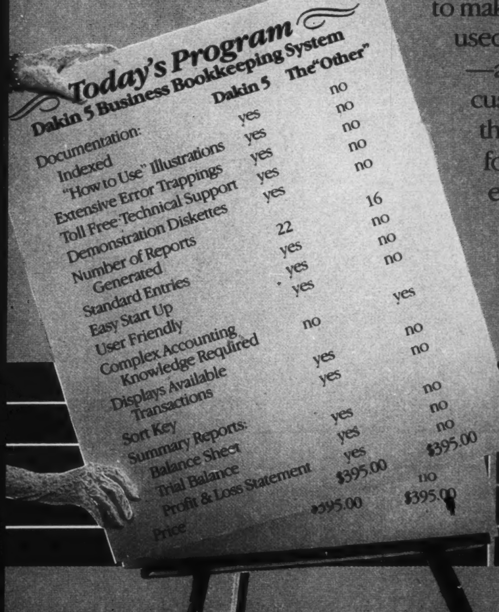

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Toll Free Technical Support	yes	no
Demonstration Diskettes	yes	no
Number of Reports Generated	22	16
Standard Entries	yes	no
Easy Start Up	yes	no
User Friendly	yes	no
Complex Accounting Knowledge Required	no	yes
Displays Available Transactions	yes	no
Sort Key	yes	no
Summary Reports:		
Balance Sheet	yes	no
Trial Balance	yes	no
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CIRCLE 155 ON READER SERVICE CARD

Franklin Ace 1000
Peripherals and Software Tested

Peripheral

- Microsoft Z80 Softcard
- Apple Controller 2 drives
- Wesper 80-Column Video Board
- Mountain Computer Clock
- Wesper BPO Printer Buffer
- Apple Parallel Printer Board
- Micro-Sci Controller and Drive (1)
- Hayes Modem II
- MPC SIO Serial Printer Board

Software

- Super-Text II
- Sargon II
- Space Eggs
- Gorgon
- Universal Boot Initializer
- Flash! I/B Compiler
- S-C Assembler 4.0
- Data Capture 4.0/80
- CP/M and Basic-80 (MBasic)
- Locksmith 4.1
- CP/M and Wordstar W/P
- Visicalc
- Pascal

(1) Optional drive supplied by Franklin

Table 3.

in, or you can use slot 0 for memory expansion of your choice. To use slot 0, you make cuts to a designated block on the main circuit board.

There are several other memory options you can select through cuts and jumpers with this board option too. They are described in the User Manual. A reset button is provided under the left front edge of the case.

Operating the Ace 1000 is much like running an Apple II. I remove all the cards from my Apple — except the language card — and inserted them in the Ace 1000. Without exception, all of them worked.

I used the dual drives from my Apple for most of the test. Drives available from Franklin are Micro-Sci drives (reported to be manufactured under license by Franklin). I tested single Micro-Sci drive and controller and both worked without any apparent problems.

To gain further assurance I tried a sampling of software from my collection. Other than the minor problems alluded to above, everything worked. Table 3 summarizes the peripheral cards and software I used in the evaluation of the Ace 1000.

Software

Because most all Apple programs expect upper-case input, you must press the shift lock key to make them work (the minor problems). For instance, with *Super-Text,* the character X is used to print a file. A lower-case x wouldn't execute. Furthermore, a filename typed in lower-case wouldn't save. Upper-case filenames worked fine.

Another difference, again with *Super-Text,* concerns shift key operation. With the Apple II and a Videx Keyboard Enhancer, a certain key sequence is required to make the shift key work typewriter style.

By experimenting, I found a sequence that performed a similar function with the Ace 1000 keyboard. First, ADD mode is selected. Next, the shift lock is pressed, followed by a CTRL-C. Now the shift lock or shift key generates upper-case characters. Using a CTRL-P, the code for starting a paragraph, caused the steps just described to terminate their response. My solution was to use the tab function to indent paragraphs.

In addition to the *Super-Text* word processor, I tested *Word Star* running under Apple CP/M. My test was rather limited but showed that it worked at least enough to write a short letter, save it, recall it, and make local and global changes.

Included in the Ace 1000 service manual is a patch for the *Applewriter II* word processor. The patch lets you modify *Applewriter* so it will recognize the keyboard features of the Ace 1000.

Software provided with the Ace 1000 is limited to a Master Disk. Most of the programs are utilities and are much like those included with DOS 3.3. Each program is described in the Users Manual. Diagnostics are also included on the master disk. These utilities will help you locate a problem should you experience difficulty in operating the system.

Except as noted earlier, all programs from the Apple II master disk worked. Integer Basic was loaded into the expansion RAM and it worked too. In fact, the utilities such as the mini-assembler and those from the programmer's aid ROM worked very well.

Along with a check on the machine language utilities, I tried PEEKs,

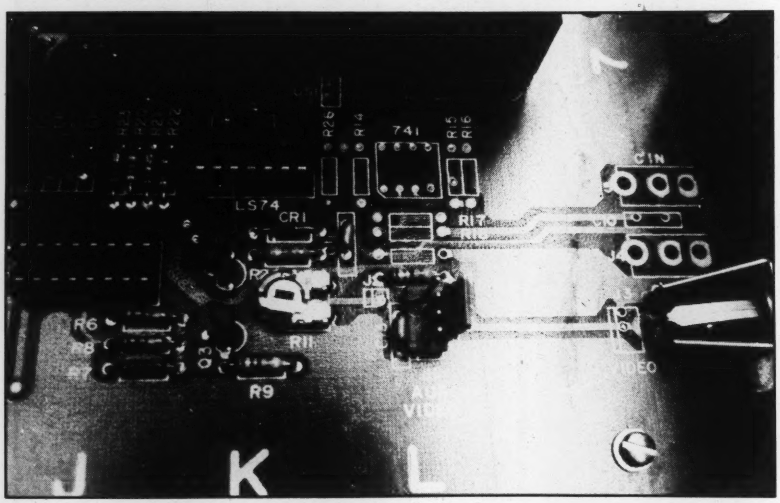

Figure 1. Circuits for cassette interface are included in the circuit board etch. However, the cassette input/output routines are not included in the monitor firmware.

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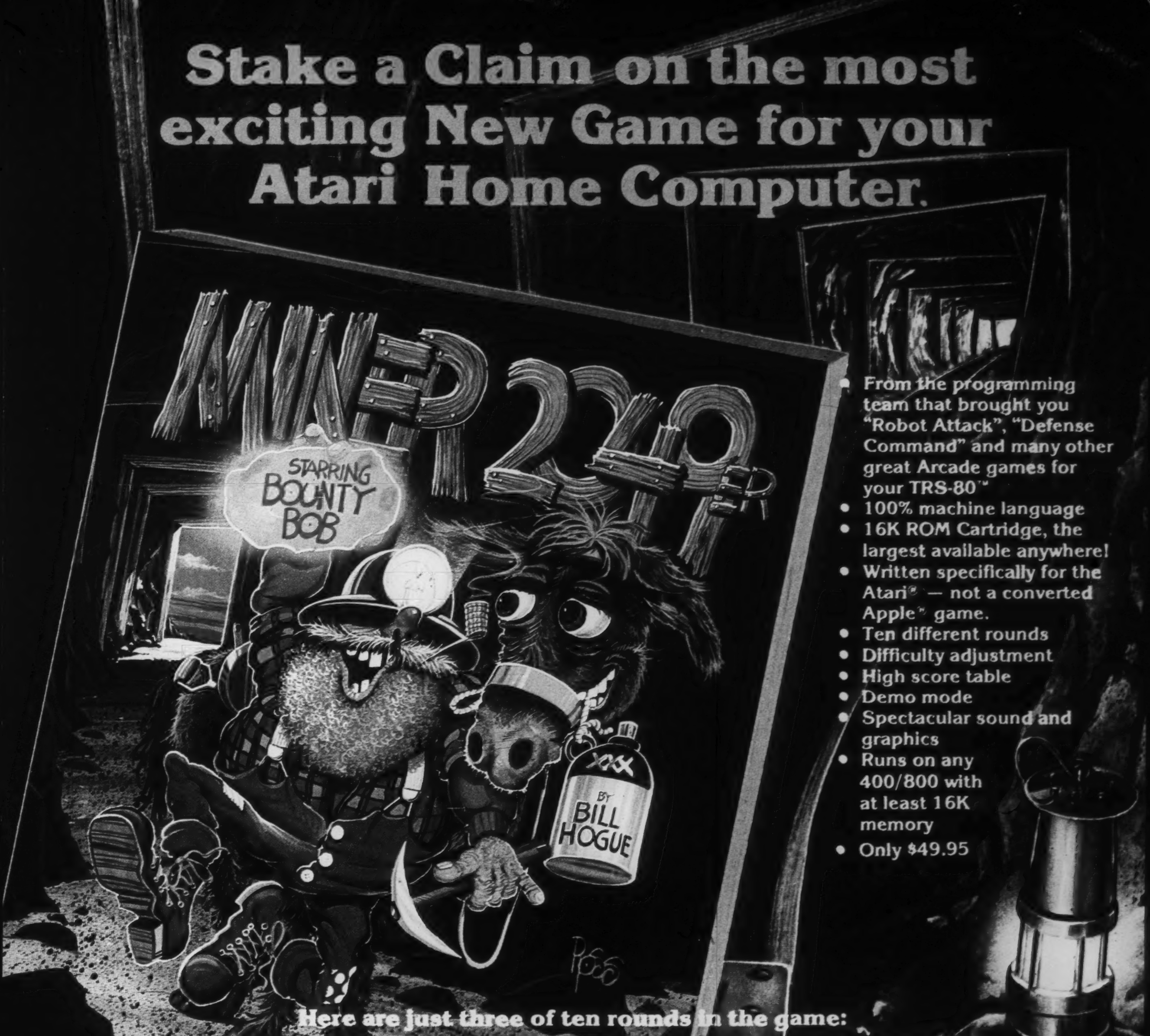

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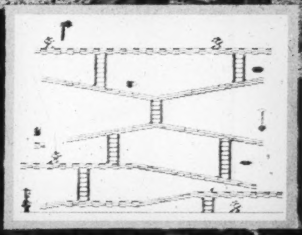
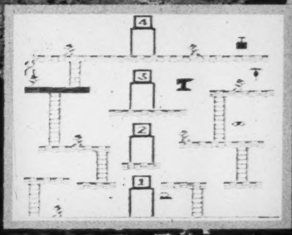
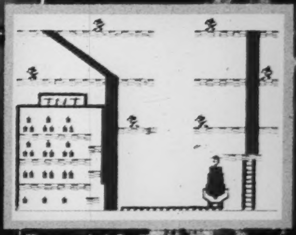


Round 1: The Mine Shaft.



Round 3: The Transporters.



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CIRCLE 125 ON READER SERVICE CARD

[illegible]

Franklin Ace 1000, continued...

POKEs and CALLs from the Integer and Floating Point Basics. As expected, as long as no routines from the cassette I/O are used, all access to memory locations functioned properly.

Documentation

Documentation is rather sparse. The Users Manual is all you get. If you want to learn any more than how to operate the machine, look elsewhere. There are no descriptions of programming languages included in the manual.

In fact, there is less information in the Ace 1000 manual than there was in the first Apple II manual. At least the original Apple manual included memory usage, a summary of machine language and Integer Basic commands, and sample programs. I expect some improvement in the area of documentation very soon.

If you are considering purchasing the Ace 1000 as a second Apple-like computer, all you need to know is how the new system works. More than likely you will already have all the documentation you need to describe programming languages. If Ace 1000 will be your first machine, locate and purchase as many of the Apple II manuals as you can.

Conclusions

For those who want to use a personal computer as a word processor, the Franklin Ace 1000 is an excellent choice. The full size upper- and lower-case keyboard is a delight to use. This review was written on the Ace 1000.

If you want a system, as I do, with flexibility, ease of expansion, and functional utility, the Ace 1000 will do the job quite nicely, especially if you are considering a second computer and already have documentation. Software for personal, business, professional, and development applications is available through many sources.

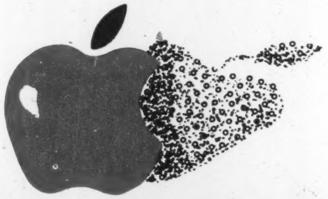
If you are interested in color graphics, however, forget it. The Ace 1000 generates only shades of grey and black and white (assuming you use a black and white monitor). A color adapter board is "soon to be available." It will plug in to one of the expansion slots.

Based on my evaluation of the computer, I suspect that any software or peripheral that will work on an Apple II, will work on the Franklin Ace 1000.

The Apple II is probably to be at the peak of its product life right now and, the Ace 1000 should help to stimulate the market for Apple-compatible products. The new Apple work-alike products won't injure the Apple market, they will enhance and sustain it.

One caveat: make sure the company manufacturing your Apple work-alike will support the product. Franklin appears to be establishing the required support network. High Technology, the local distributor, has been involved with factory training programs through Franklin. In turn, High Technology provides training and support for its dealers.

Franklin Computer Corporation, 7030 Colonial Hwy., Pennsauken, NJ 08109. (609) 488-1700. □



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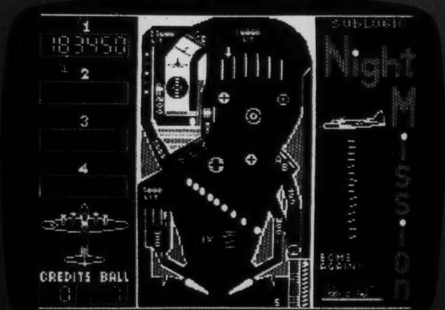

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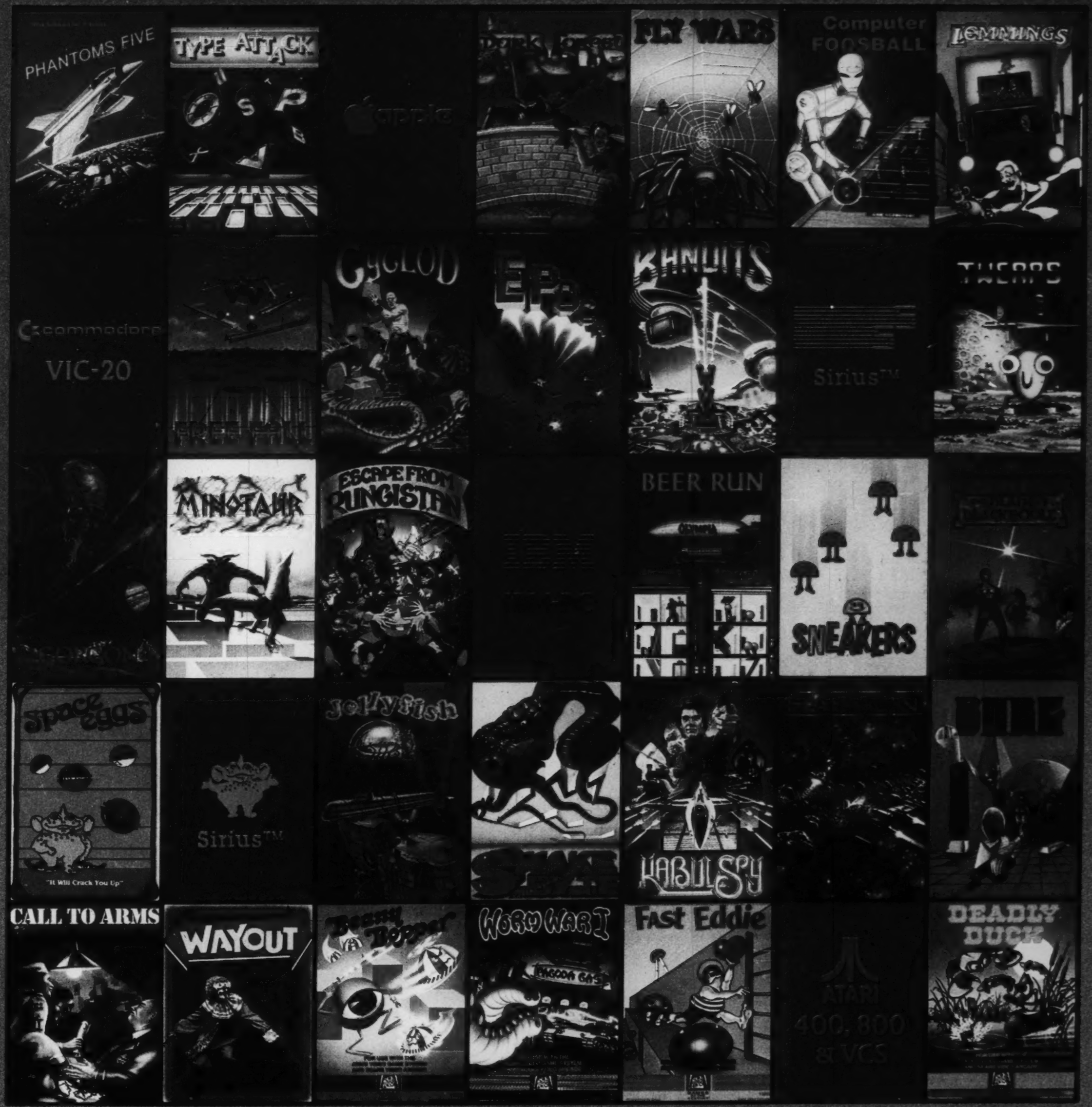
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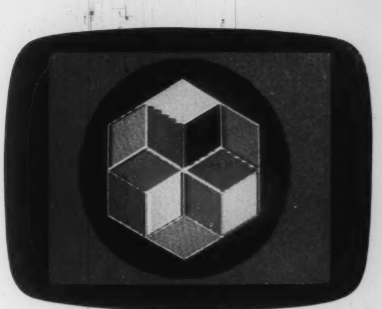

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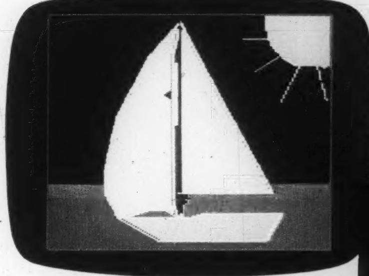

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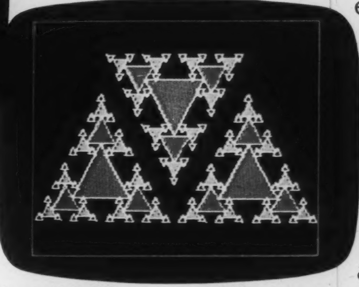

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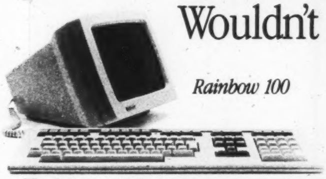

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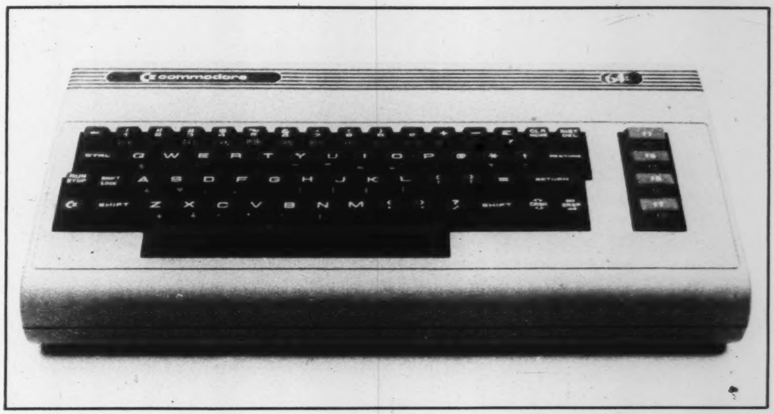
A Best Buy For '83

Ron Jeffries

The Commodore-64 is a lot of computer for the money. For only $595, it comes with 64K of RAM memory, excellent graphics, a three-voice sound synthesizer, Microsoft Basic, a 6510 microprocessor, a built-in RF modulator to connect with a television, and a typewriter-style keyboard.

Although not a true "open design" such as the Apple II or IBM PC, the 64 has several easy-to-use input/output interfaces built in. There is even a cartridge slot that will allow a Z80 microprocessor or game cartridge to be added to the system.

Commodore has announced that the popular CP/M operating system will be available when the Z80 cartridge is released in early 1983. A single 5¼″ floppy disk (Model 1541) is available for an additional $399.



Not A 40-Column Vic

The 64 is packaged in a plastic case that looks exactly like the Vic-20, except that it is brown instead of white. But don't let that fool you: the 64 is *not* a 40-column Vic. The two computers share only two features: the plastic case, and the same version of Pet Basic.

Vic programs that don't use any of the special Vic graphics or sound and that do not rely on the 22-column screen will run on the 64. Unfortunately, those constraints severely limit the number of Vic programs that will work on the 64.

The 64 uses a 6510 microprocessor. The 6510 is exactly like a 6502 (which is used by the Pet, Vic, Apple, and Atari) except that the first two bytes of page zero have been "stolen." These two memory locations are used for an on-chip 8-bit input/output port by the 6510. The 64 uses this port to control its memory map, which makes it unusually flexible.

For example, when a game cartridge is plugged in, the 64 automatically acts just like the Commodore Max Machine game console. This means that the 64 is an inexpensive development system for programmers who want to write Max games.

Excellent Keyboard

The first thing that impressed me when I unpacked the 64 was the excellent keyboard. Several people who have wandered by my office have tried the keyboard, and their comments have all been quite positive.

As is true of most computer keyboards, some keys are not placed where they would be on a standard typewriter. If you are a touch typist, be sure to type for a few minutes on the 64 keyboard before you decide to buy it. The placement of keys on the 64 probably won't bother you.

The keyboard of the 64 is sculptured, which means that the tops of the keys are slightly concave when viewed from the end of the keyboard. (Some keyboards look like a staircase when viewed from that angle.) Most typists seem to prefer the sculptured design, which is what IBM uses for their popular Selectric typewriter.

The 64 keys also have a matte, nonglare surface that is attractive. The "feel" of the keyboard is above average, although for my taste it is a little softer than ideal. There is no audible click when a key is pressed, a feature I have come to appreciate on machines such as the Atari 800.

As a point of reference, the IBM Selectric keyboard is the best I have ever used. My favorite personal computer keyboard is the IBM PC. It has a sharp, "clicky" feel that works very well for me. I rate the 64 keyboard about 7 on a scale of 1 to 10, with the IBM PC rating a 9, and the Selectric getting a perfect 10. Obviously, the $600 64 does very well in comparison with the much more expensive IBM PC.

The 64 keyboard has a somewhat high

R. K. Jeffries, 5266 Hollister, Suite 224, Santa Barbara, CA 93111.

profile. The home row of keys is 70mm above the desk surface. (The 64 looks higher that it is. For example, the fairly sleek Atari 800 has a 77mm high home row.) A low profile keyboard such as the IBM PC places the home row of keys approximately 30mm above the desk top. Research in human factors has shown that low profile keyboard design reduces fatigue in users' fingers and hands.

Commodore decided to use a slightly modified Vic plastic case for the 64, even though that meant having a high profile keyboard. On the other hand, by using existing plastic tooling, they were able to get the 64 to market several months sooner than if they had designed a new case. (They probably also saved $20,000 to $50,000 in development costs.)

Advanced Graphics

The graphics capabilities of the 64 are exciting. Commodore-64 graphics are more powerful than those of the Atari, IBM PC, Apple, TI 99/4A, or Radio Shack Color Computer. (The 64 also has far stronger graphics than its cheaper cousin, the Vic-20.)

The most important feature is its dedicated hardware support for rapidly displaying eight detailed objects anywhere on the screen. Each of these objects (Commodore calls them *sprites*) can be 24 pixels wide and 21 pixels high, or about the same as a block of 3 x 3 characters.

After a sprite is designed, and the dot-by-dot pattern for the display (called a *bit map*) is stored somewhere in memory, the sprite can be moved around on the screen very quickly and easily. All the programmer has to do is POKE the horizontal and vertical location into the appropriate registers of the dedicated graphics procesor called the "Video Interface Chip," or VIC. The VIC chip directly supports eight sprites at one time. (In machine language it is possible to "re-use" sprites, and thus have more than eight of them on the screen at once.)

Sprites Are Versatile

Each sprite has a priority. This allows one sprite to appear to pass in front of another sprite, so that three-dimensional effects are possible. The video chip also keeps track of collisions between sprites, and between sprites and the foreground. This can be very useful when writing sophisticated game programs.

Each sprite can be enlarged to be twice as wide, or twice as tall, or both. However, when a sprite is enlarged, there is effectively half as much resolution, since the same bitmap of 24 by 21 pixels is used. (The pixels making up the sprite are enlarged.)

Likewise, a sprite can use four colors (instead of the normal "on" or "off") at the expense of having half as much resolution.

Until you can see an example program that uses sprites, it is hard to understand what a powerful tool they are. Machines like the Apple that do not support sprites face tough competition from those like Commodore, Atari, and Texas Instruments that do provide this facility. (See "Personal Electronic Transactions" in this issue for more on 64 sprites.)

Video Problems?

In my opinion, the quality of the video image produced by the 64 is poor. So far, I have seen the displays of six 64 computers, and have yet to find one that is as crisp and sharp as the Atari 800 or 400 models, for example. Since I am using a fairly early production model of the 64, this problem may be corrected by the time this review appears in print.

Many combinations of text and background colors produce an unreadable display.

For some reason, the characters on the 64 appear to be "smeared" on the display. This effect is least visible when there is reduced contrast between the character color and the background. I suspect that is why Commodore decided to have the 64 display light blue characters on a dark blue background when it is first turned on. However, this combination of foreground and background colors does not provide as much contrast between text and the background as other popular systems.

Many combinations of text and background colors produce an unreadable display. The background color (as well as the border color) can be changed with two POKE commands. After some experimentation, I have found that blue text on a white background looks pretty good, although it does exhibit some of the character smearing. I trust that Commodore plans to improve the quality of the display.

Music Synthesizer

The 64 produces sound using the 6581 Sound Interface Device (SID). This special chip is a music synthesizer and sound effects generator. It provides three voices that can be controlled by the user.

For each voice, you can control pitch over a nine-octave range. The waveform can be a triangle wave, sawtooth, variable pulse, or noise. (You can create great sound effects for games with the noise waveform. For example, it is easy to produce explosions, shuffling feet, or ocean waves.) For each voice, you can also control volume, and there is a master volume control.

For each of the three voices, you can control what are called *envelope generators*. The way a note or sound effect sounds when it is produced is the result of many different things. Naming the envelope of a given sound is a shorthand way of describing four of the important parameters that control how it sounds.

There are four parameters that describe an envelope: attack, decay, sustain, and release, or ADSR for short. With the 64, the attack rate can be varied from two milliseconds to eight seconds. Both the decay and release rate can range from six milliseconds to 24 seconds, and the sustain level can range from zero to peak volume.

After spending quite a bit of time using a *sound editor* that makes it easy to build new sounds and then experiment with changing them, I am very impressed with what the SID can do. Frankly, I can't remember the last time that I have had this much fun (at least with a computer). When I start playing with 64 sound generation there just doesn't seem to be a good place to stop. Many 64s will be purchased solely because of the SID synthesizer.

Given the excellent sound and graphics capabilities of the 64, it is too bad that Commodore did not choose to support the new hardware at a high level in Basic. All of the sound and graphics are controlled with POKE statements that change magic memory locations. POKEs are inconvenient for experienced programmers, and completely mystifying to novice users.

Microsoft *has* extended Basic to support graphics and sound on other machines such as the IBM PC. So why was the 64 released with version 2 of the same old Pet Basic, which does not support the new hardware features?

I think that Commodore decided that the 64 would sell very well *without* an enhanced Basic. After all, the 64 is priced relatively low for the features. (Using the existing Pet Basic is another way that development costs were minimized.)

Will there ever be an enhanced 64 Basic? I think it is unlikely. My guess is that a better version of Basic will be one of the features of the $995 P-500. The new computer will have the same color graphics and sound as the 64, and will

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The 1541 Disk Drive

In addition to supporting the standard Commodore cassette tape format for storing programs and data, the 64 can also be used with the Vic-1541 disk drive. (The original Vic-1540 drive requires a new ROM in order to work with the 64.)

The 1541 uses a 5¼″ drive that stores approximately 170,000 bytes. The drive is a single-sided unit that uses Commodore's unique disk format, and is packaged attractively, although the case is white (like the Vic-20) which doesn't match the tan color of the C64.

The disk format used by the 1541 is compatible with the standard Commodore 4040 disk drives that have been used for several years with the Pet and CBM models. This means that disks can be transferred among the 64, the Pet, and the Vic-20.

In the case of data files, no changes should be needed when interchanging files. Pet programs can be transferred to the 64 easily. Many Pet programs work on the 64 after minimal editing. Programs that POKE screen locations must be changed, since the screen has moved.

Changing the CB2 sound of the Pet to use the SID chip isn't difficult, if you use this formula:

```
10 HS = 2 ↑ (1/12)
20 SID = INT(.5 + 14*HS
     (LOG(255/CB2)/LOG(HS)))
```

Where SID is the value to POKE into location 54273, and CB2 is the value that was POKEd into location 59464 on the Pet. Naturally, you have to have the other SID parameters set up correctly for the 64 sound to work.

Commodore plans to release what they call a Pet emulator for the 64, that will do much of the dirty work for you. I think that converting a Pet program to the 64 is a better approach, since there is no runtime overhead, and you can take advantage of unique 64 features such as color, user-programmable characters, sprites, and of course multiple-voice sound.

"Smart Peripheral" Problems

The disk operating system for the 1541 resides in ROMs that are in the 1541, rather that in the 64. The advantage of this approach is that the DOS doesn't consume any RAM in the computer, since it has its own RAM on the disk controller.

Commodore takes great pride in the fact that their system has what they call "smart" peripherals. What this means is that each disk unit or printer has its own microprocessor, and can accept commands from the "main" computer, such as the 64.

How to Transfer C64 Programs to the PET

Taking 64 Basic programs to the Pet is somewhat complicated. After LOADing the 64 program into the Pet from disk or cassette, use the PET monitor as follows:

```
SYS 1024
```

At this point, the monitor will display the contents of the 6502 registers. We can ignore them, and type the M command to display a portion of the PET memory:

```
.M 0400 0407
```

The command shows the contents of the seven bytes that begin at location 0400 hex. We will ignore the values that it displays, and type the following in their place:

```
.: 0400 00 01 08 00 00 00 00 00
```

After pressing RETURN, exit from the monitor with the "X" command:

```
.X
```

Now, in Basic, type a zero and press RETURN. What we have done is play a trick, using the machine language monitor. We created a fake line zero in the monitor, and then deleted it in Basic. If your program already has a line zero, it will not be deleted, since Basic will only delete the first line zero that it encounters, which will be our fake line.

Unfortunately, there is a fly in this intelligent peripheral ointment. Basically, the disk is a very independent device. The 64 sends it a command, the disk attempts to perform the requested action, and then sets an error code. Note that I said "sets an error code," not "tells the computer whether things worked or not."

The problem with the Commodore aproach is that the user program (or the user, in the case of commands from the keyboard) is responsible for discovering that an error has occured. When something doesn't work, the 64 does not print an error message on the screen.

The result of all this is that Commodore disk systems such as the 1541 are not among the easiest to use when compared with other personal computer systems. Evidently, there are many consumers who either don't know the difference, or don't care, because Commodore disk systems seem to sell very well.

Limited Disk Speed

The 1541 disk transfers data slower than several other personal computer disk systems. For a simple benchmark, I used a program that writes 10,000 bytes to the disk. (To keep the interpretive overhead down, the program uses a FOR loop that goes from 1 to 500. Each time through the loop a string of 20 bytes is written to the disk.) The 64 with the 1541 disk took 34.8 seconds to write 10,000 bytes. The standard Pet 4040 took 17.5 seconds, and the Atari 800 took 28 seconds with "read-after-write" disabled.

Atari is the only personal computer that automatically reads each sector after it is written. However, this Atari "feature" can be disabled by typing POKE 1913,80. With read-after-write *enabled*, the Atari 810 disk took 46 seconds for the benchmark. The IBM PC with IBM DOS took 11.4 seconds to write the 10,000 bytes.

I ran each disk test several times and averaged the results. Also, the old data file was scratched by using a keyboard command rather than in the benchmark program. To my surprise, I found that scratching a file from the disk takes quite a while.

Furthermore, the amount of time taken to scratch a file depends on the location of a file on the disk in several popular disk operating systems. For example, with the 1541 disk, a scratch command can take a noticeable amount of time.

Since most consumers don't bother to time the performance of their disk drives, the important question about the 1541 may be "Is it fast enough for the average user?" The answer is a qualified "yes." If you mainly use the disk for program storage, *any* disk is much faster than a cassette tape recorder. But if you plan to use the 64 for disk-intensive data management, you should do some serious benchmarking before making a purchase decision. At $399, the 1541 is one of the least expensive disk units available for personal computers.

Conclusions

The Commodore-64 is an excellent value. For $595 you get powerful graphics, a complete sound synthesizer, and a versatile computer with 64K of memory. At the moment, I think it is the "best buy" in the $600 personal computer price range. Now if you'll excuse me, I need to get back and tune-up my 64 snare drum sound effect...

Acknowledgements: Glen Fisher of The Code Works provided numerous clarifications of the technical details of the 64. David Rosenwald of Commodore was most helpful in providing hardware and software. ☐

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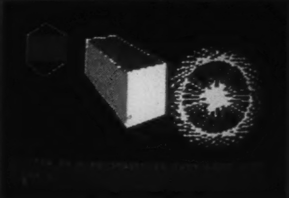

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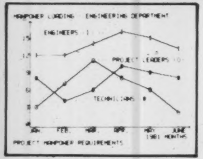
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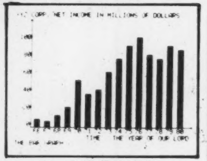
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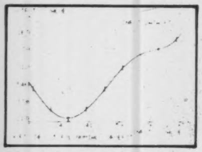
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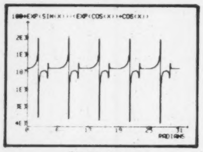
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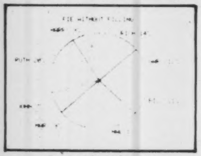
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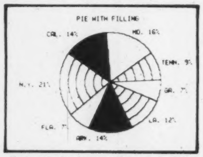
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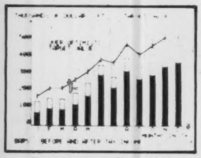
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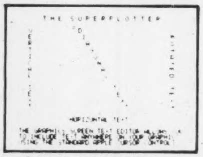
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7 Years Ago in creative computing

The November 1975 issue was almost entirely devoted to the impact of the computer on society. In the lead piece, an interview with Senator John Tunney, he expressed the opinion that in Presidential elections, computerized projections should not be announced until all polls have closed. He said "In 1964 and 1972, for example, I believe that voters in the west, after hearing projections of Presidential landslides, lost interest and didn't vote. This absenteeism especially affects statewide and local races and issues." Prophetic words. Tunney was defeated four years later for probably those same reasons.

We published the results from a major survey of public attitudes towards computers. Many results were not surprising, but one that was was that nearly one-fifth of the respondents believed that most errors were made by the computers themselves and not by programmers and operators. Let's hope that computer literacy has improved a bit by now.

Terry Ireland and Norm Glick wrote a wonderful piece, "Eclectic Programming Languages," in which they longed for intuitively extensible languages. "Perhaps," they said, "the ultimate instruction will be, "You know what I want. Do it!"

I visited Terry recently and he felt that Ada and Pascal were hardly steps in the right direction, and did not encourage new classes of users to learn about computers.

In that issue we reviewed the first episodes of *Space: 1999*, a new TV show (lasted two seasons). We speculated that videodiscs would be commonplace in 5 to 10 years (we were wrong). We mentioned the newly-formed Micro-8 User Group for people building computers with the Intel 8008 (not 8080) chip (it lasted 1½ years). And we announced Computer Recreations, a system like The Source and Micronet but five years too early.

Craig Johnson's monster Span-O-Vision computer predicted that the height of the public's negative reaction toward computers would occur in 1985 when a computer would erroneously schedule 9 million reservations in Yellowstone Park causing the great camper wars. We'll see. ☐

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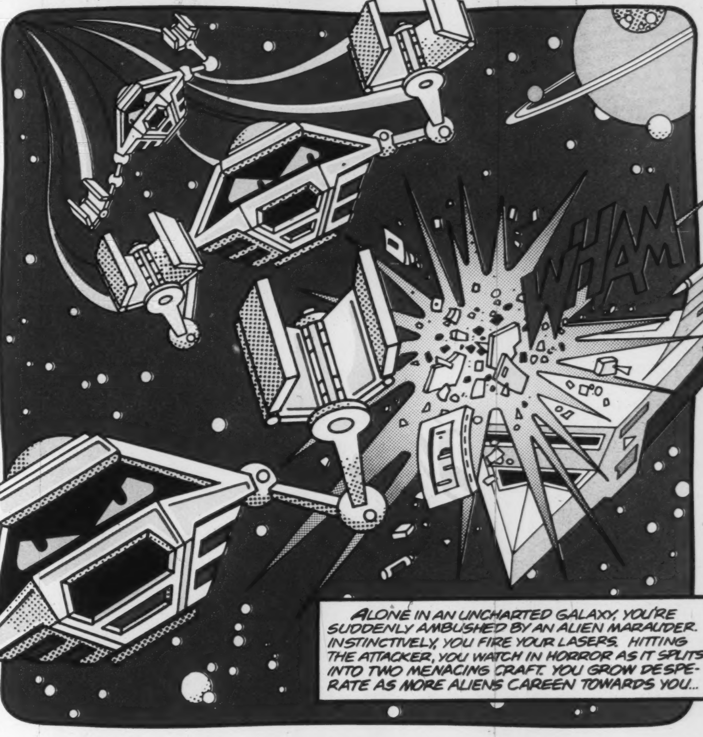
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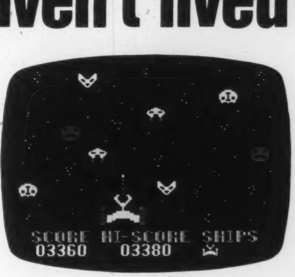
by Peter Fokos

You haven't lived until you've died in space.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Software author Peter Folkos has created Alien Ambush, a space age nightmare. It's a hi-res, full-color arcade game, fiendishly written to give those nasty aliens every advantage.

So if you have access to a 48K Apple* with DOS 3.3 or a 16K Atari 400/800** with a disk drive, and you're hot for some new thrills, Alien Ambush was written for you. But be warned: it just got a lot tougher to survive in space.

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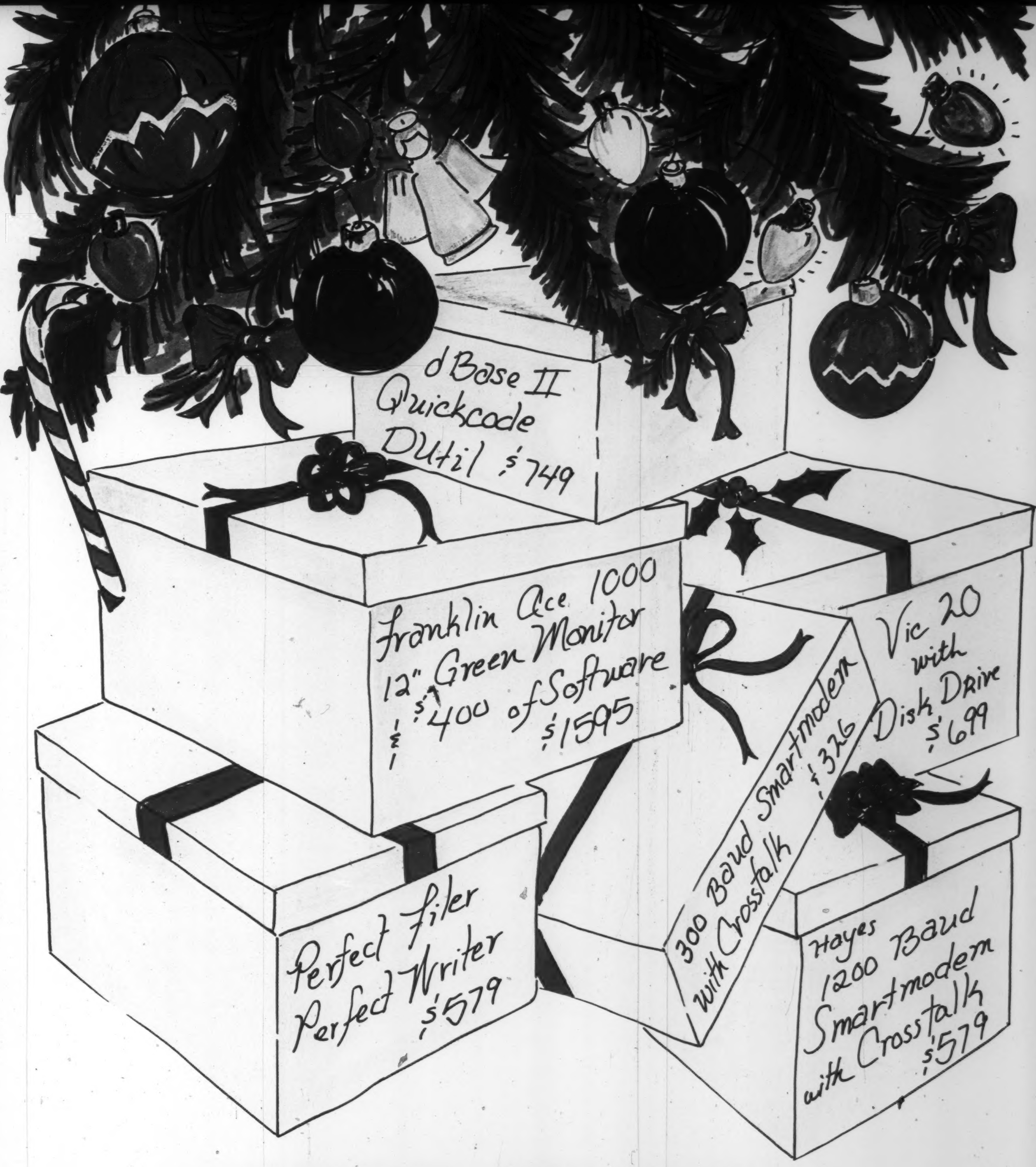
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Amdek Color II RGB Monitor

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James L. Hockenhull

Many computer users have been attracted to the Apple II because of its ability to produce color video graphics. Those users whose visual ambitions go somewhat beyond zapping the Klingons—will probably be interested in obtaining the best possible display of Apple video.

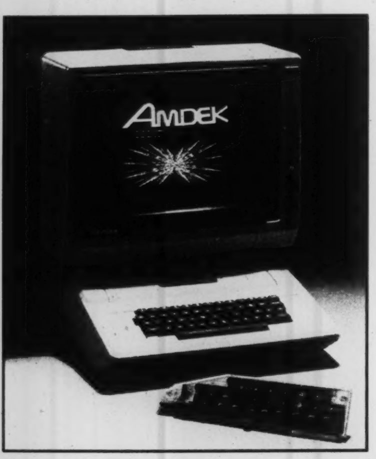

Figure 1. The Amdek Digital Video Multiplexor (DVM) board (foreground) for the Apple II, and the Color II 13" red-green-blue (RGB) monitor.

An off-the-shelf Apple can produce images on two types of hardware: regular television sets through a radio-frequency (RF) modulator, and monitors fed by the composite video signal available at the Video Out jack.

The first of these is adequate for home entertainment, but the RF modulator, being in essence a tiny TV transmitting station, is subject to all manner of interference, causing jitter, ghosting, and general degradation of the image.

A video monitor, gives a much more stable picture as the computer signal is piped directly into the circuitry of the monitor. However, image quality is highly dependent upon the quality of the monitor and its ability to make sense out of the Apple video signal which deviates significantly from the standards with which a monitor is designed to work.

The best monitors can give quite a good picture; the worst are hardly better than television sets. Some will not accept the Apple video signal at all.

Top-quality professional graphics devices, those used with mini and mainframe computers, do not use a composite video signal. Rather they work with three separate signals, one for each of the color guns in the display tube—red, green, and blue, hence the acronym RGB. The Amdek Corporation (formerly Leedex) of Arlington Heights, IL has made this professional display technology available to Apple II users with their Digital Video Multiplexor (DVM) and Color II RGB monitor.

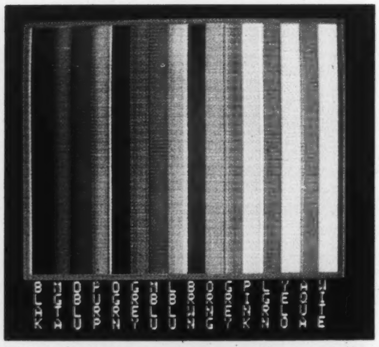

Figure 2. The full range of the Apple lo-res colors as displayed on a composite video monitor.

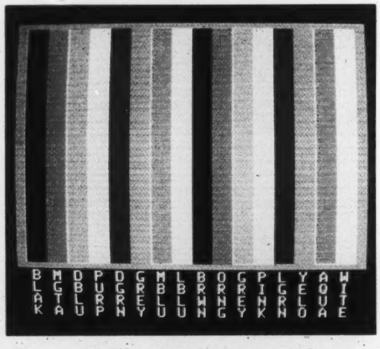

Figure 3. The Apple lo-res colors as they appear on the Amdek Color II red-green-blue (RGB) monitor. Colors are limited to black, red, green, yellow, magenta, cyan, and white. The Amdek text is clear and free from color fringes.

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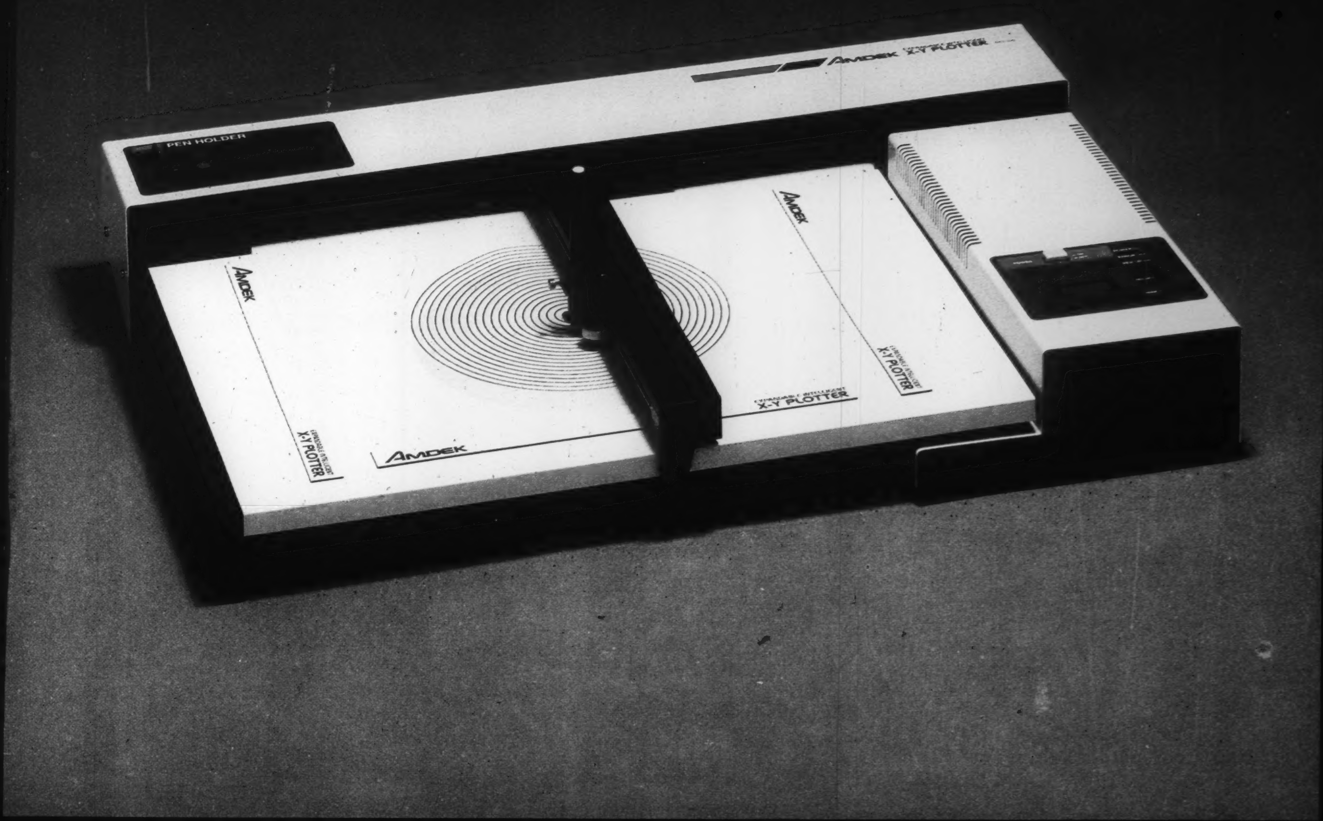

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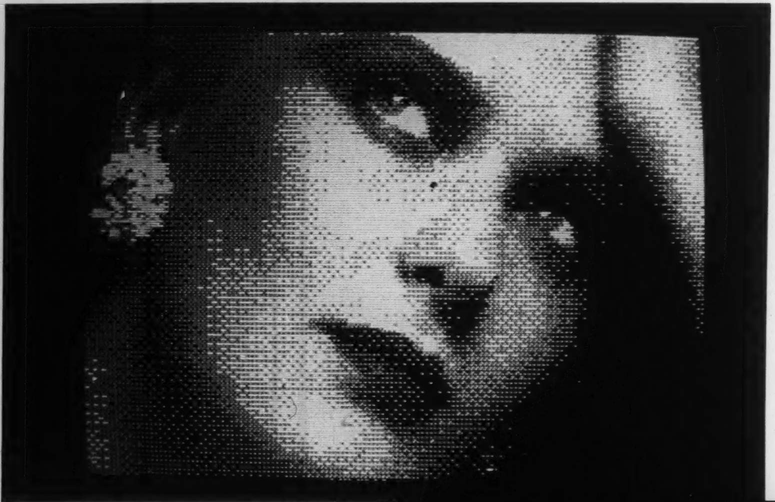

Figure 4. A familiar Apple hi-res image, shown on the Amdek Color II monitor, driven by the DVM board.

Digital Video Multiplexor (DVM)

The DVM, which retails for $199, is the heart of the Amdek system. It picks signals from various parts of the Apple video-generating hardware and puts out red, green, and blue signals along with separate horizontal and vertical timing pulses. Timing information is critical to image quality; that produced by the DVM appears to be much closer to industry standards than that produced by the Apple.

The main printed circuit board of the DVM is a large one. Eleven inches long, it extends well toward the front of the computer case, with its top front corner cut off to clear the case cover. The board carries 37 integrated circuits (ICs) mounted in sockets.

In addition there are two satellite "daughterboards" which fit between certain of the Apple ICs and the motherboard. A cable connects the daughterboards to the main DVM card. A second cable supplies output to a 9-pin D-type connector but also makes a branch to pick up 40-column text input from pin 2 of the Molex connector at location K-14 of the motherboard. Obviously the production of well-timed RGB output is not a trivial matter.

Three channels of the DVM supply red, green, and blue signals. A fourth channel is provided for use with an 80-column text board.

High-Resolution Monitor

The Color II high-resolution monitor superficially resembles a nicely-designed 13" color television set. Its beige and black plastic case measures 16⅞" x 14½" x 15", and its feet are spaced so that it will just fit on top of the Apple case. It retails for $899.

A look at the controls makes it apparent that the Color II is not just another TV: on-off, contrast, brightness, and vertical hold. Period. There is no volume (there is no speaker), no color, no tint, and, of course, no channel selector. This is a specialized machine.

The documentation supplied with

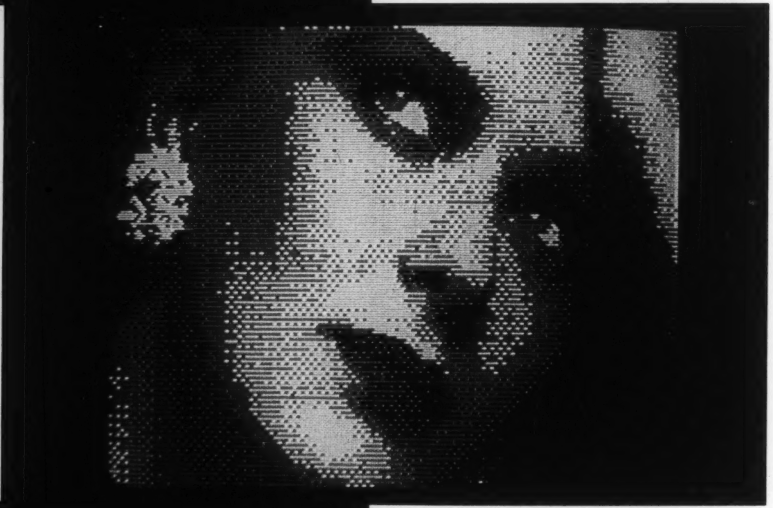

Figure 5. The image as it appears on a high quality video monitor.

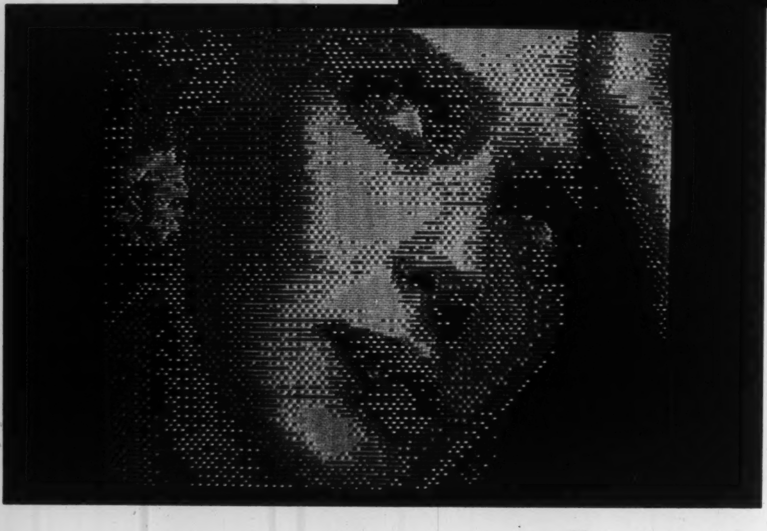

Figure 6. The same picture on a television receiver, driven by a popular radio frequency (RF) modulator.

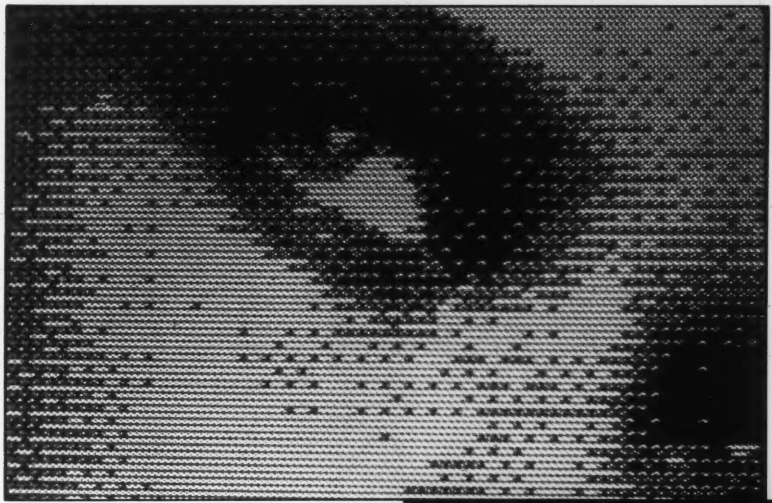

Figure 7. A close-up of the Amdek image.

the Color II is "consumer oriented," disappointingly so, in my opinion, considering the professional quality of the monitor itself. Seven of the eleven pages in the booklet are taken up with such matters as location of controls (since there are only five controls, this is not too complicated), how to turn the set on (ditto), and several pages of precautions, with little cartoon figures beset by sweat-beads, X's, and exclamation points illustrating such warnings as "Do not hold anything by the power cord" and "Do not apply a shock by dropping, crushing, etc." I mention this simply because I believe that those who purchase expensive, professional-quality equipment expect, deserve, and *need* professional-quality documentation.

The last four pages get down to facts, describing the signals required by the Color II, giving a pin-out of the input connector, and offering diagnostics in case the input signal is not correct.

Input is through a standard Type-I 8-pin video connector which expects red video, green video, blue video, horizontal sync, vertical sync, and ground — exactly the signals produced by the DVM board.

Installation and Setup

Installation of the DVM involves more than simply dropping the card into a peripheral slot; integrated circuits must be removed from the motherboard and inserted into sockets on the daughterboards which, in turn, must be inserted into the motherboard. One who has never handled ICs would be well advised not to learn by practicing on the computer.

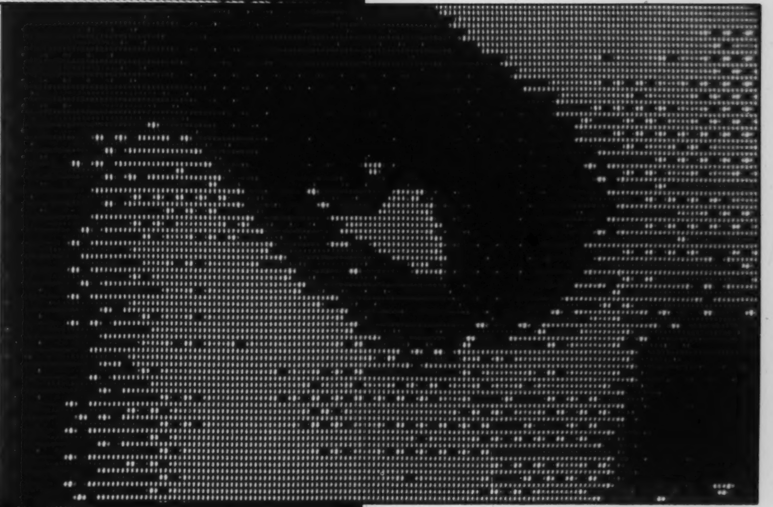

Figure 8. A close-up of the video monitor image.

On the other hand, anyone with even a small amount of experience should have no trouble with the installation, although the price of an IC puller and inserter should be figured into the total cost.

Having issued these warnings, I will say that installation is straightforward and shouldn't take much more than twenty minutes.

The manual includes instructions for connecting to a Videx Videoterm

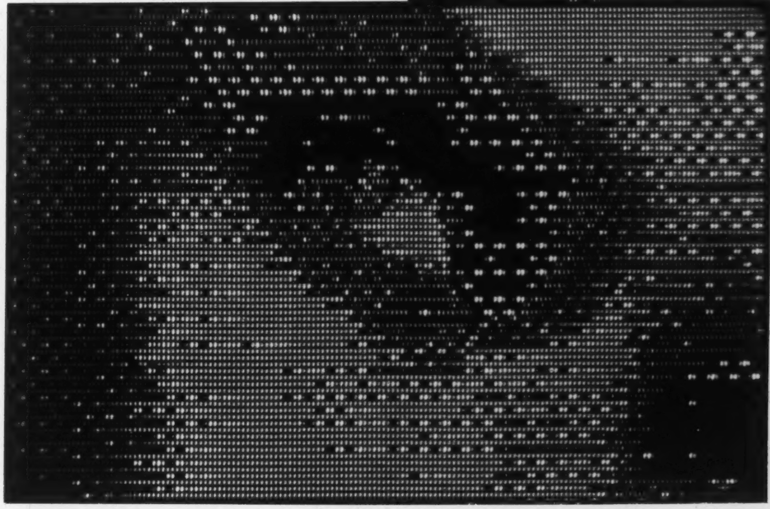

Figure 9. A close-up of the TV image. Notice the dramatic differences in resolution.

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We'd like to help. So here are a few suggestions about how to buy the computer that's right for you.

Computers come in two parts.

One part is the "hardware," which is the machinery itself. The other is the "software," or a program, as it's sometimes called.

Software is the part that tells the computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything.

And vice versa.

You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember, it's the software that knows how to get things done), it makes good sense to pick the software first.

Start by making a list of the things you want to use the computer for. It can include almost anything—any kind of inventory, filing, accounting, graphics, reporting, record-keeping, analysis—you name it and there's probably a software program that does it.

Next, take the list into a computer store and ask the salesperson to give you a demonstration of the program, or programs, that will do the things you want.

Even though you'll need a computer for the software demonstration, keep in mind the computer is just a vehicle. The software is the driver. And once you've decided on the software, picking out the rest of the computer system will be much easier.

The simpler the better.

Look for software that's easy to learn, easy to use, and that does the job in the simplest way possible.

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Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you have to do without getting in the way. Meaning there are no complicated routines to follow to perform a simple task. And no programming language to learn.

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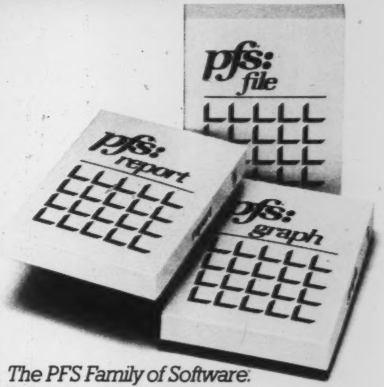

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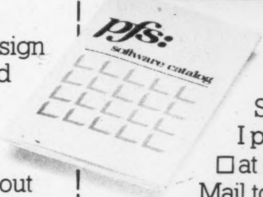

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CIRCLE 267 ON READER SERVICE CARD

80-column text card, requiring the soldering of three male Molex pins to the Videoterm. These pins were not included with my evaluation unit, nor was the connecting cable fitted with the necessary female connectors. With nothing more to go on than the blurred photographs and skimpy pinout information in the preliminary manual, I would have to forego the Videoterm connection, although Amdek assures me that the results are spectacular.

Use and Evaluation

The Color II/DVM is transparent to the user; that is, nothing special or different needs to be done when the system is in use, with two exceptions. First, the manual recommends that, when in the hi-res mode, plots should not be made to the coordinates at the extremes of the screen—X coordinates 0 and 279, Y coordinates 0 and 159 (mixed mode) or 191 (full screen mode). When references are made to these coordinates odd "artifacts" may appear on the screen. This means that the graphics display area is reduced slightly and that minor modifications may have to be made in existing programs.

Second, the three color channels are software selectable. Any or all of the guns can be turned on or off by accessing the appropriate memory locations, in much the same way that Apple screen modes are selected.

Shutting off a color gun will, of course, have a pronounced effect on a graphic image, but if the red and blue channels are defeated, the Color II becomes, in effect, a green-phosphor monitor which is wonderfully easy on the eyes for text work. (An extensible language, Forth, for example, allows commands such as GREEN and COLOR to be added to the language system to take full advantage of this capability.)

"That damn computer thinks it knows it all!"

The Pros

The first thing I noticed when I brought up the Amdek system was its silence. I spend a lot of time in front of cathode ray tubes (CRTs) and I'm often made uncomfortable by the high-pitched whine so characteristic of TVs and monitors. The Color II is silent.

Silence is golden, but graphics is where the virtues of the Color II/DVM really become apparent. The image, first of all, is stable. It doesn't flicker or twitch or crawl or herringbone but sits there rock-steady like the image on a mainframe terminal. If noise should appear it can usually be eliminated by adjusting a trim pot on the DVM board.

And, oh, the color! I have seen my graphics work on everything from discount house television sets to studio monitors, but I have never seen anything like the Color II/DVM system. The colors are deep and rich; the blue is that blue usually obtained only by oversaturating a regular monitor, the orange is very close to red. Yet when switching back to the text mode there are *no* color fringes around the characters.

However, least we think we're in heaven, of the 15 lo-res colors, only black, red, green, yellow, magenta, cyan, and white are available. (See Figures 2 and 3.)

The screen image is not only stable and colorful but has extremely sharp resolution and focus, a good thing since the manual gives no hints as to how focus or convergence may be adjusted.

I am a computer artist (for want of a better term). I make my work portable through photographic reproductions, usually 35-mm color slides shot from a video screen. It was natural, then, to test the Color II by shooting a group of slides for comparison with those taken from other devices. The slides show, rather dramatically, the superior clarity and resolution of the Amdek when compared to identical pictures from a high quality composite video monitor of the same screen size. Of course there is absolutely no contest between the Color II and a standard television receiver. (See Figures 3-8.)

It would be nice to report that I preferred the Amdek slides in all cases, but occasionally their clarity was outweighed by the broader range of colors available on composite video monitors. The Color II slides also showed noticeable "barrel distortion" —all four sides of the image being markedly convex. This surprised me as the actual screen image appears to be quite rectilinear. The distortion may be due to some optical effect between screen and camera or it may be that the squareness of the Color II is more psychological than actual. (Some amount of distortion is unavoidable when shooting from any CRT.) These complaints notwithstanding, the slides from the Color II were excellent.

The Cons

Someday, perhaps, a perfect product will be made, one about which nothing negative can be said. To the best of my knowledge, that day has not arrived. I do have a few other minor grouses about the Amdek system which I shall now list in no particular order.

My eyes find the 13" screen too large for comfort when the Color II is sitting on top of the Apple. I have had to move the unit to the table behind the computer where it serves very well.

The Color II does not provide a way to kill the color for black and white work. Because of the unusual Apple color structure, a white rectangle may have one green side and one violet. Put another way, the accuracy of the Color II points up the oddities of Apple color video output. Sometimes this can be annoying.

The output connector of the DVM does not fit neatly in any of the access slots at the rear of the Apple; it simply hangs out at the end of its cable. This may seem like a minor matter, but it is a jarring bit of inelegance in a well-designed system.

And, of course, expense must rear its ugly head. The Color II/DVM combination is not cheap, listing for just about what a bare-bones computer costs. For what market is the system targeted? Amdek estimates that from 10% to 15% of all Apple users are involved in serious graphics applications and will be potential customers. Doubtless, others will be able to afford the best for their more recreational pursuits.

Having voiced the preceding complaints, I shall conclude by saying simply that it doesn't get any better than this. If you don't like Apple graphics on the Amdek Color II/DVM system the chances are that you won't like Apple graphics anywhere. Both devices are well conceived, free of frills, and meet or surpass their advertised claims. I recommend them highly to those who want the finest in display devices. ☐

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The General Manager

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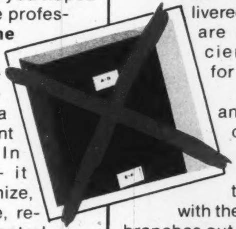

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Graphics Processing System and Graphics Magician

Great Graphics Simplified

Brian Murphy

The best software programs are those which help you to explore the capabilities of your hardware, which open up new possibilities, and which stimulate your creativity. Stoneware's *Graphics Processing System* (professional version) for the Apple II is this kind of software.

Let's face it. The most attractive feature of the Apple II is its ability to put great high-resolution color graphics on the video screen. Who isn't impressed, walking into a computer store and watching an Apple II go through its paces for the first time, with the graphics which flash on the video screen. When Apple added the graphics capability to the Apple II, they built in a most effective sales device.

Once you have your Apple safely deposited in your home or office, the next impulse is to do something with it — to add some of those great graphics that you saw in the computer store. That's where the *GPS* comes in.

GPS saves you the trouble of learning the programming tricks (worthwhile as they are to know) in your Applesoft Tutorial and Applesoft Manual. Instead, you are called upon to master a step-by-step tutorial which *GPS* has written for the individual who shies away from programming. It is a short course you can master in three or four hours of work, and at the end graphics will flow from the tip of your light pen.

Actually, a light pen (Symtec's is specified) is only one way of operating the program. You have the options of using a joystick, game paddles, a HIplot or graphics tablet. For the purposes of this profile, we tried it with the joystick, light pen and Apple Graphics tablet. The tablet proved to be the quickest and easiest instrument to work with.

The best feature of the *GPS* package is its speed. It loads fast and brings up the options from its many and varied menus quickly, expediting your work. To make a menu selection, requires only that you guide the cursor, using your drawing instrument, over the option you desire. It lights up, and then, to choose it, all you do is press the pen down (or push the paddle button or touch the light pen ring).

The entire program, as you may have gathered, is menu driven. You access the branch menus from a main selection offering the options of Draw, Erase, Modify, Duplicate, Display, Group, Information, and Cancel. Draw is the default selection (the one you get if you don't guide your cursor to another selection before pressing the button).

The Draw Menu

In the Draw menu you do the actual creative work. Your options are freehand or line drawing, change of line color (more on color in a moment), erase, cancel and end. Freehand, of course, is the option that lets you draw whatever shapes you prefer. The only limit is the amount of memory you fill up as you draw. Freehand is the easiest option to choose when you have an Apple Tablet.

creative computing

SOFTWARE PROFILE

Name: Graphics Processing System

Type: Graphics generation system

System: 48K or 64K Apple II with
Applesoft, disk drive,
choice of joysticks, paddles,
Symtec light pen, Houston
Instruments Hiplot or
Graphics tablet

Format: Disk

Language: Applesoft

Summary: Software that truly
simplifies graphics.

Price: $99.95

Manufacturer:
Stoneware Incorporated
50 Belvedere St.
San Rafael, CA 94901

Making a freehand drawing using the game controllers or a joystick is awkward and the results are frequently unsatisfying, unless you were a champion Etch-A-Sketch user as a kid. Good results are obtained with the Symtec light pen.

The line option is more suited to the paddles. In this mode, the cursor leaves a dot on the screen where you press the button. You move to the next point and press the button and a line appears connecting the two points. Moving on from the second point a line will connect it to the third point when you press the button, etc. The only limit is the amount of memory you fill up. In the line mode you can create geometric figures or, if you gain skill in using the *GPS*, detailed line drawings to illustrate reports, etc.

A word about color. In the default mode, the line color in freehand or line drawing is white on a black screen. This translates to black on a white background if you decide to print hard copy of your graphics. Thus, if you are generating computer graphics to illustrate a report, you don't have to tinker with the color option.

If you use the color option, you have two whites, two blacks, a green, an orangy scarlet, and a light and a dark shade of blue with which to work. Some of the colors can be blended with others, if you select two at a time, but this process is better suited to the filling procedure, which we'll get to later. It is enough to say that you can put down scarlet, light blue, dark blue, white, and green lines. You can also place black lines on the screen, but you'll have one heck of a time seeing them.

After you have created one or two figures, you may decide that you don't like any of them. If so, you can choose the cancel option and the figures will disappear, the memory will be freed up and you can start over.

There is, however, the possibility that you are dissatisfied with only one line on one of your geometric figures. Using the

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Brian J. Murphy, 133 Post Road Rd., Fairfield, CT 06430.

erase option, you can erase your line drawings, one line at a time. In the same mode, you can rub out portions of your freehand figures.

Modifying The Picture

With a finished figure, you now have the task of choosing the end option. This makes the picture you have drawn an "object," which is an important distinction in several ways. For example, in the Modify option of the main menu, you can take the object you have created and fill it in with solid color. You can combine blue with scarlet, any of the colors with white or black, or scarlet with green. In the blended colors, the hues are not solid; the effect is achieved by alternating horizontal lines of the colors you are mixing.

If you prefer, you can change the background color in the Modify/Color mode. If you opt for a white background, you can return to the Draw menu and, by selecting the color option from that menu, add new objects drawn in black. (You'll remember that a black line was invisible against a black background.) If you print hard copy of the result, you'll get what appears to be a negative image—white lines against a black background.

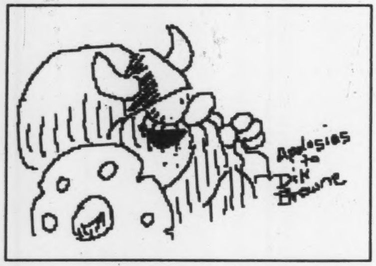
If you are drawing maps or charts, you can use the Modify/Color mode to give you an all-green or all-blue background, thus eliminating some of the labor of filling in color for large areas denoting sea or land and also saving precious memory.

While you are still in the Modify menu, you can choose to move an object using the Position option; to squeeze it, using the Proportion option; or to enlarge or reduce it, using the Size option. In fact, using the Size option you could, for example, make detailed drawings of many different objects, reduce them, and put them all in the same picture (switching back and forth between the Draw and Modify menus). Or, if you like, you can take one object from your picture and focus on it, omitting undesired objects from your finished product without having to erase.

If the positioning is okay, but the object appears to be out of kilter horizontally or vertically, you can rotate it, using the Rotation choice in the Modify menu. This leads to the interesting possibility of creating a series of pictures of the same object, by spinning the same picture around a single point of reference. A series like this looks nice in hard copy.

Finally, the Modify/Order option allows you to take the objects you draw and stack them on top of one another. For example, if you were to draw a picture of an apple tree, then of Adam and Eve, you could have them hiding coyly behind the tree.

We have arrived now at the only serious limitation of the program: the amount of memory it occupies. Chances are, if you are doing a complex freehand drawing, at some point the Apple II will beep and the text window will come up with the single, ominous prompt, "Memory Full." If you have a 16K RAM card (that is, if you have at least a 64K system) you press the button once to return to the main menu and select Cancel. Then you move the cursor off the screen entirely and hit any key. The screen will go blank. Then press the B key.



The screen will immediately light up again with the picture you have been working on. The difference is that it is now in the background; the program has put all the information in the 16K card, freeing up memory for more drawing. There are restrictions on what you do now. If you add an object to the picture and then try to use the Modify/Size option, the object will grow, but not the background, which includes all the objects you drew right up to the Memory Full statement.

The Display/Zoom Option

There are other manipulative tricks available. Using the Display/Zoom option, for instance, you can zoom an object by several orders of magnification and then return to the Draw menu to add detail. When you have finished, you can return to the Display/Zoom mode, elect not to zoom, and the picture, with your additions, will zoom back down to scale.

GPS comes with an extra diskette, containing the "Special Features," one of which is the text font. This font proved to be hard to manipulate; I found it very difficult to get the letters in a word to sit evenly and in line. Anyone who has struggled with transfer lettering know what I am driving at.

The problem is that, hard enough though it would be to keep all the letters level if you could see them, they remain unseen until you have guided them into place with your cursor. As I said, I found it very difficult, but I suspect that with more practice it can be mastered.

Also, on the Special Features disk is a Grid Maker, which does just that; it puts a grid of lines on the screen for use in preparing graphs. Once you store the grid on disk, it is treated by the *GPS* format as an object, to be enlarged, reduced or otherwise at will. This could be a valuable feature in preparing quick graphics to go with a word-processed report.

At last, skipping over other features and functions too numerous to detail here, we arrive at the important part, the storage to disk. Once your work is complete, you need only choose the Duplicate menu and select the Apple option. This will give you the opportunity to select a name and store the picture data on disk, ready for use in any Applesoft program. If it is hard copy you need, the selection of the Duplicate/Printer option will instantly set your printer to work duplicating your graphics onto paper.

This is one big software package for $99. The *Graphics Processing System* gives you a great deal of flexibility to draw what you want, in the detail and colors you like, and to get those graphics into your program the way you would want. To do the same job that the *GPS* program does in only a few minutes would take a great many program lines, much dot plotting and a great deal of time, armed only with the Applesoft Tutorial, fine as it is.

Stoneware sums it up claiming that what a word processing system is to text, or an advanced spreadsheet program is to numbers, *GPS* is to graphics. It's the simple truth. This program does not do tricks with shape tables, animation, animation paths and so forth, but for a business user who wants to add graphics to his word processor-generated reports quickly, to the teacher who wants to add graphics to his software and to the home user, who just wants to explore his hardware and his creativity, this program will be flexible and useful.

Graphics Magician

Have you ever wondered how adventure games like *Mummy's Curse* and *Cranston Manor* get all those pictures onto one disk? If you have taken the time to learn the graphics portion of the Applesoft Tutorial, you might have noticed that the pictures you make tend to use up a great many disk sectors. A picture weighing in at 33 disk sectors may not seem very large, but your Disk II diskettes can story only 496 sectors of information. That works out to about 15 pictures 33 disk sectors long.

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long it must take to create one of those drawings? The hi-res art in, for example, *Cranston Manor* does not challenge the artistic avant garde, but those pictures are hard to recreate, piece by piece, using the methods outlined in your Applesoft programming books. You could spend hours and days working on just one of them.

creative computing
SOFTWARE PROFILE

Name: The Graphics Magician
Type: Graphics program, programming aid
System: 48K Apple II or II+ with Applesoft, disk drive, paddles
Format: Disk
Language: Machine language and Applesoft
Summary: Excellent programming aid for pros and advanced amateurs.
Price: $59.95
Manufacturer: Penguin Software
830 Fourth Ave.
Geneva, IL 60134

There is something that explains all these mysteries, the Penguin *Graphics Magician*, by Chris Jochumson, David Lubar and Mark Pelczarski. This software package is the answer to the prayers of serious programmers who need good, hi-res graphics, in quantity, in a reasonable length of time. Not only that, the *Graphics Magician* lets you do the kinds of tricks with animated shapes that you see in the best games. The message I am trying to get across (the heck with being subtle about it) is that the *Graphics Magician* is miraculous and marvelous.

Using game paddles only, which I regard as fairly inefficient means of drawing under ordinary circumstances, I was able to create drawings using this software that would not look at all out of place in any of the current best-selling adventure games. Another few minutes of homework with the supplied documentation, and I was able to work the pictures into my own programs — as easy as a HIMEM, a POKE, and a CALL, to paraphrase Penguin's manual.

Picture/Object Editor

It is the Picture/Object Editor mode of the *Graphics Magician* which lets you do this part of the magic. To get there, you select, obviously, the Picture/Object Editor option from the main menu which appears at the beginning of the program when you boot the disk. The options which you are offered when the Picture/Object mode comes up are to catalog the disk, load an old picture for new work, or start a new picture.

In the new picture mode you see a blank white screen with a flashing cross hair cursor. You are in the line mode, which means that when you press the button in paddle 1, you will establish the starting point of a new line.

With a little practice it all comes together quickly. Using the button on paddle 0, you can draw a line from your starting point to the present location of your cursor. If you want to start a new, unconnected line, you just press button 1 and move the cursor to the desired spot.

This kind of flexibility, so simple and so logical, allows you to put lots of images on the screen, fast. Soon you will be ready for fill-in color. Here's where the real fun begins.

You have a palette of 100 colors from which to choose. In a picture I drew of a castle gate and drawbridge, for example, I used two shades of brown, two of blue, two of green, and four of grey. Hues are mixed by alternating bands of color and darkened by the addition of dots and lines. The result is that you have a very wide range of color selection. The difficulty encountered in drawing curved lines is more than made up for by the colors which can be used.

If you make a mistake, correction is simple. You can either type D to delete the last command given or go into the Edit mode to delete the mistake instruction and, if you like, insert new ones. This makes it easy to get your proportions right and to change colors if necessary.

When you have a finished picture, the program will store it on disk. The programs are easily retrievable, using up about two disk sectors of your 496 to write the appropriate commands in Applesoft or machine language to bring the picture up.

Animation

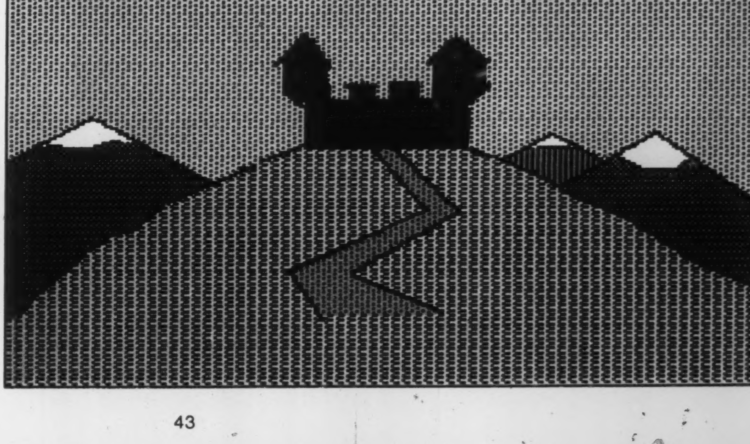
You would normally assume at this point that I have described about all there is to this program, but now we come to a new and even more magical segment of the package, the Animation System. In this mode you create color shapes (available colors are blue, white, orange, violet and green) that you can later animate. The job of animation is done literally bit by bit, using single key commands to maneuver a miniscule cursor and to imprint a color dot as desired. Going slowly and patiently you can create rather realistic airplanes, figures, flying saucers, etc.

You will find, when you choose this mode, that there are seven sets of cursors. Over each cursor is an orange bar. You can turn off a bar by typing a number (the documentation tells you which bar corresponds to which number) and turn it back on again with the same number. As you maneuver the cursor and imprint the dots, you get identical pictures for each cursor with the bar "on". Nothing drawn where the bar is "off."

If you like, using this feature, you could have your figure (of a man, for example) appear to move his arms and legs as he walks by moving the limbs a little in each of the seven shapes you draw. On the other hand, if you wanted to show a car smoothly gliding along, you would leave all the shapes "on" at the same time, repeating the shape seven times.

In animation the "car" would move, but there would be no internal movement. Were you to leave one or two of the pictures off for the entire shape creation process, the animated shape would see to disappear briefly.

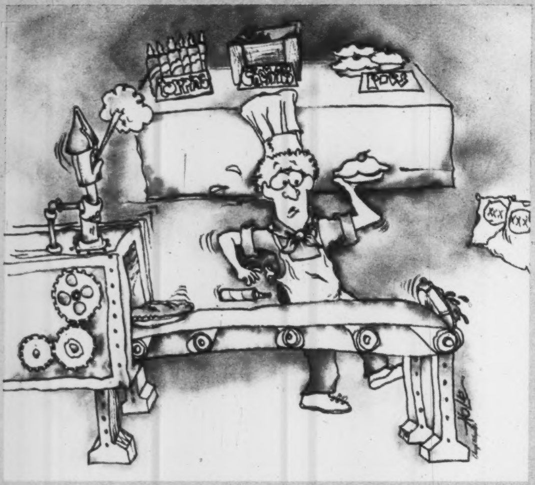
Having created a shape and animated it, the program now enables you to create -



SPY'S DEMISE

Arcade Action by Alan Zeldin

Somewhere on each floor of the Soviet diplomatic mission in Pyongyang are the nine parts of an encoded message. Your future is assured if you can just find those pieces and put them together, and then solve the puzzle. But to do so you must avoid the embassy guards who make frequent rounds at unscheduled intervals. They don't ask questions first, either.



PIE-MAN

by Eagle Berns and Michael Kosaka

You got a late start looking for that summer job, and all you could find was a baker apprentice position at the Automated Bakery Company. Simple enough, since the pies are made by machine . . . all you have to do is add topping and put the pies away when they come out on the conveyor belt. Shouldn't be too difficult of a summer, you think to yourself . . .

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Above games now available for the Apple computer. Arcade games work with keyboard, joystick, or Atari joystick. Graphics for all above created with the aid of The Graphics Magician.

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CIRCLE 232 ON READER SERVICE CARD

Apple Graphics, continued...

a path for it. Again, by using single key commands, you can send your shape in any of eight directions on the screen. The path is saved separately from the shape.

It is in the Animation Editor that you put the shapes together with the paths to create complete routines which you can add to your game programs or graphic demonstrations. At any time you can go back and edit any part of the routine you have created. You can take the path you have used and ally it with different shapes. You can take a shape from another file and mate it with the path for an entirely new routine. These possibilities give you a good idea of how flexible this software really is.

It should be noted that the documentation, while giving you a basic rundown on the program commands you need to integrate your pictures and animation into your programming, is written with experienced programmers in mind. Beginners will find the documentation to be rough going at first, but with patience they will soon be able to put the Animation System and the Picture/Object Editor go through their paces.

Super Shape Editor

Another aspect of this software package is the Super Shape Editor. This time you work with Applesoft shapes, which are defined either as pictures on screen or in tables. Once you figure out how the system works, the drawing goes quickly.

You can draw in seven colors. your line may be from one to 255 points in length. It can be lengthened or shortened at any time. Using the paddle button, you determine the tilt of the line and give the command when it is to be drawn. Using lines one or two points long, and after practice at setting the angles, you can make curing lines or sharp, geometric shapes as you prefer.

A nice thought is that the shapes take up about half as much memory space as an Applesoft shape table would need. This means extra space for text and pictures in your programs.

The capabilities in the Penguin *Graphics Magician* are like those of the Apple II. What they can do is limited only by the creativity of the user. Creative programming pros will find that the *Graphics Magician* allows them to do more, do it quicker and make the end result more attractive and exciting. That's all anyone could ask of a graphics magician. ☐

Figure Notes: All Penguin graphics are by the author. They were drawn in the On-Line style of graphics as a homage to their games. All *GPS* graphics are freehand creations of the author.

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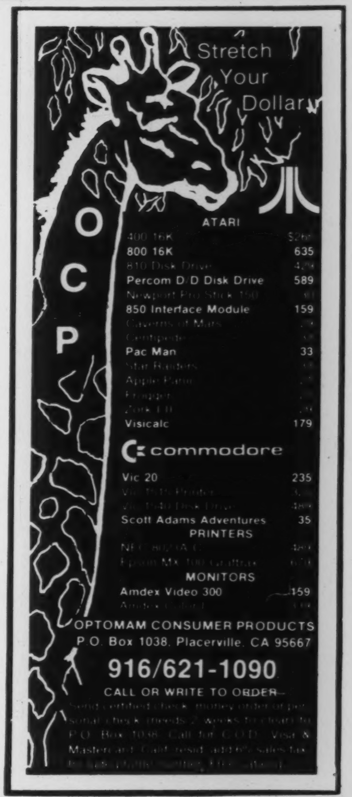

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CIRCLE 223 ON READER SERVICE CARD

A Comparative Review

Ada for CP/M

The following review of two Ada subset compilers is the third in a three-part series on the Ada language.

Geoff Gilpin

You have to feel some compassion for anyone who would try to implement the Ada language on an 8-bit microcomputer. Face it, Ada is *huge*! Stuffing all of Ada's features into a Z80 processor would be like trying to pour Lake Michigan into a bathtub.

Yet reasonably complete versions of PL/1 and Cobol, languages which are much more at home on big mainframes, have found their way into the 8-bit world. But could the power and complexity of Ada be crammed into my little desktop friend? I was (and am) skeptical.

Tentative answers to the Ada-for-CP/M question have been provided by Supersoft Inc. of Champaign, IL and RR Software of Madison, WI; the other implementations that I have seen advertised run on the heftier 16-bit machines.

Supersoft Ada

Being a cautious pioneer, Supersoft is quick to point out that theirs is "presently an incomplete implementation of the Ada programming language." But they promise that their compiler "will be further developed to enable implementation of the complete Ada language." When? "By the time that Ada has been recognized by the microcomputer community as a viable language for software development." Okay.

Supersoft Ada is supplied on disk and is available in most CP/M formats. The disk contains ADA.COM, the Ada compiler; CODE 8080, a program which takes Ada pseudo-code and generates a COM file and Kapse, the Kernal Ada Program Support Environment, a collection of I/O and other useful run-time routines that loosely conform to specifications for the STANDARD and INPUT OUTPUT packages provided by the Department of Defense.

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SOFTWARE PROFILE

Name: Supersoft Ada
Type: Ada subset compiler
System: 48K CP/M
Format: Disk
Language: Machine code
Summary: Very limited subset of Ada
Price: $250
Manufacturer:
Supersoft Inc.
P.O. Box 1628
Champaign, IL 61820

In addition to the three system files, Supersoft provides several sample programs including two games, Startrek and Mazewars. As an Apple II owner running Ada on the Microsoft Z80 Softcard, I should mention that some of the demo programs require an 80-column screen and would have to be re-written for the Apple. Even though I use a Videx 80-column board, some of the programs used cursor-positioning commands that did funny things on my screen. Be warned.

Two documents are supplied with the disk—Supersoft's Ada manual and the DoD's own Military Standard reference, bound in khaki and written in an appropriately faceless militarese. In contrast to the DoD manual, which is thick and exhaustive, the Supersoft document is quite terse—a mere 29 pages. Mostly, it describes the differences between standard Ada and Supersoft's version. The longest section lists the parts of the language that Supersoft has left unimplemented.

The Compiler

Operation of the compiler is straightforward. Once an Ada source program has been created with ED or another CP/M text editor it is compiled by typing "Ada" followed by the filename. If you have included the PRINT or LIST pragma in the source text (*pragma* is the Ada term for a compiler directive) you will get a program listing on either the screen or printer, as requested.

Syntax errors are noted by an arrow pointing to the spot where the compiler found a problem. In my experience, Supersoft's error messages aren't always to the point. For example, as the compiler was parsing a program containing the following statements:

```
array(0):='X'

while array(0) /= 'Q' loop
```

Geoff Gilpin, 1018 N. Leminwah St., Appleton, WI 54911.

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an error was indicated at the loop statement, and a message saying "assignment operator expected" was printed when the problem was obviously a missing semicolon on the previous line.

My long association with Pascal has convinced me that a compiler should at least be able to catch missing semicolons. Other misleading error messages are produced when the user tries to redefine Ada's reserved words—another thing a compiler should be able to sniff out.

There are a couple of other minor quirks. Although the advertising promises "printer output," the documentation doesn't mention how it's done, and so far none of the several methods that I have tried has sent a single character to my Qume. Also, the "list" pragma (for sending program listings to the CP/M LST device) doesn't work (I have tried it on two different systems).

Many Omissions

I recognize that these are the kind of small flaws that could be found in the first release of any major software package. I do have one serious complaint, however, which will appear after a more thorough tour of Supersoft Ada.

There are more data types and structures in Ada than in any other language that I have seen. There are seven predefined numeric types; scads of data structures including such exotica as array slices and variant records; and an infinite number of custom-built types and structures.

From this potpourri, Supersoft has implemented just six data types and a single data structure: arrays. No records. No user-defined types. Just the usual integers, Booleans, and characters.

A similar situation exists in one of Ada's most crucial areas: program organization. Modularity is the hallmark of Ada, and it is supported through features such as subprograms, separate compilation, packages (collections of Ada resources something like "units" in UCSD Pascal), and program libraries. The intent is to divvy up Ada programs and data in little boxes which can be accessed only through the correct protocol. This should encourage portability and make it easier to build large systems from small standardized building blocks.

How does this philosophy of divide and conquer fare in Supersoft Ada? Consider this:

Ada subprograms (specifically procedures, although functions are also supported) can accept three types of parameters—*in*, *out*, and *in out*. The last are used in subprograms which accept a value, modify it, and return it to the calling environment. Incredibly, Supersoft Ada supports only *in* parameters. That's right—any variable which is to be modified by a subprogram must be declared globally, just as in Basic. And this is the most sophisticated kind of program structure available in the Supersoft compiler. So much for modularity.

There are other strange omissions—like the lack of an *exit* statement to terminate a basic Ada *loop*—that would make serious programming very difficult.

In fact, only one of the unique features of Ada seems to have been implemented—subprogram overloading (the creation of two or more subprograms that share the same name).

After all that, I believe that the nature of my "serious complaint" should be pretty obvious. It is, ahem, this: *They only implemented a tenth of the language!*

To be fair, I realize that the Ada language itself is still in a period of transition. Some of the 16-bit versions haven't yet implemented the more esoteric features. Even the DoD's language definition hasn't quite solidified yet.

But does this justify a price of $250 for what is essentially a "mini-Pascal"?

Supersoft is apparently sticking to its intention of providing the full language. But they have many man hours ahead of them, and if the cost of the updates (which would comprise about 90% of the language) is proportional to the first release, I don't know anybody who will be able to afford them.

Janus

Fortunately, there is an alternative—Janus, the Ada compiler offered by RR Software. RR doesn't call their product "Ada" because they have no intention of bringing it up to the full DoD standard. That's good.

The large-scale, exotic features of Ada—such as inter-disk communication and generic program units—create so much overhead in an 8-bit machine that their implementation is, in my opinion, just plain unrealistic. RR has wisely avoided such esoterica and produced a subset of Ada that is both useful and workable.

Even with this economical approach, Janus is no lightweight. Consider:

- The Supersoft compiler takes up 16K; Janus occupies 130K (nearly two full disks on my Apple system).
- Supersoft's manual is 29 pages long with a page and a half describing error messages; RR's is 128 pages, ten of which are devoted to error messages.
- Janus supports ten programs; Supersoft implemented two (one of which doesn't work).
- Janus supports based numbers, attributes, enumeration types, subtypes, packages, and a host of other Ada features not found in the Supersoft implementation. In fact, there really is no comparison. Coming to Janus after using the Supersoft product is like being given *carte blanche* at the Ritz after a week of eating nothing but crumbs and tap water.

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SOFTWARE PROFILE

Name: Janus

Type: Ada subset compiler

System: 56K CP/M

Format: Disk

Language: Machine code

Summary: A useful and powerful language

Price: $300

Manufacturer:
RR Software
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The thoroughness and careful attention to detail that went into Janus are evident from the first compilation. The user is presented with an array of compiler options that do everything from suppressing debugging code to informing about differences between Janus and standard Ada. During the four passes of the Janus compiler, information is provided on available memory, code and data addresses, table size, and anything else that might save debugging time. In fact, Janus gives you more information than the IBM Optimizing Compiler for PL/1.

Error Handling

I was particularly impressed with the kindness displayed by Janus in error handling. Syntax errors are spotted early in the compilation process, a thoughtful feature for impatient programmers using a four-pass compiler. The much trickier run-time errors generate a useful "walk-back" that greatly simplifies debugging. Consider how Janus would handle the following, fatally flawed program.

```
package body TEST is
   function FUNC (X, Y: integer)
                    return integer is
     begin
     return X/Y;
     end FUNC;

   procedure PROC (X, Y: integer) is
   Z: integer;

     begin
     Z := FUNC (X, Y);
     end PROC;

begin -- TEST
PROC (0, 0);
end TEST;
```

The run-time error occurs in the fifth line (counting blanks) of the program where X is divided by zero. Most compilers would just give a message such as "Divide by zero at line 5" and leave it to the programmer to track the problem down. Janus gives you this:

```
*** Divide by zero detected

On line number 5 in TEST.FUNC

Called from line number 12 in TEST.PROC

Called from line number 16 in TEST
```

I imagine that this would be a godsend for people working on a big, convoluted program.

The Janus language itself represents a hefty subset of Ada—perhaps as much as 60% of the DoD specs with more to come in updates. Janus really *looks* like Ada; not like a warmed-over Pascal.

All the Ada operators are here (including relational operators for arrays, records, and enumeration values), along with most of the data types including derived (*new*) types, the *access* (pointer) type, and the non-Ada byte type. (The *task* and *limited private* types, for multiprogramming and data hiding respectively, will remain unimplemented.)

Good News For Systems Programmers

There are several extensions to Ada that make Janus particularly attractive to the systems programmer. (This isn't surprising—RR uses Janus for all their in-house programming.)

There is an ASM statement that allows insertion of in-line assembly code or other binary data. For instance, the following Janus procedure will re-boot CP/M.

```
procedure RE_BOOT is
  JMP:   constant := 16#C3#;
                     -- 8080 branch opcode
                     -- expressed in Ada
                     -- "based number"
                     -- notation.
  ENTRY: constant := 16#0000#;
                     -- CP/M entry point.

begin
  Asm JMP, ENTRY;
end RE_BOOT;
```

There is also a "conditional compilation" feature that causes certain portions of code (specifically, those statements preceded by an @ marker) to be ignored by the compiler unless the user says otherwise in the command line, or toggles the CONDCOMP pragma within the source program. This feature has already saved me some debugging time and, again, I imagine that it would be invaluable in the development of a large system.

Business programmers will be pleased to know that strings in Janus are handled differently than in standard Ada. To the great relief of all, Janus strings have a dynamic length attribute. In other words, the statements

```
S: string(1..10) := "rendezvous";
...

S := "Fred";

put (S);
```

will print "Fred" instead of "Fredezvous." Thank you, RR.

In addition to the language itself, several program libraries are included on the distribution disk(s). (The whole Janus package takes up four Apple disks or one single-density 8" disk.) There is a library of string-handling routines (STRING.LIB) to help with the everyday tasks of searching, replacing, and extracting strings from other strings.

A HEAP.LIB provides several low level functions such as garbage collection (reclaiming unused memory), individual bit testing and setting, and a MEMAVAIL procedure to keep you informed of how much space is left.

The third library, IO.LIB, is RR Software's solution to the somewhat controversial problem of Ada input/output. As defined by the DoD, I/O functions aren't really a part of the language itself; instead, a group of *generic* I/O routines are *instantiated* by each programmer whenever they are needed (somewhat like using a single stencil for drawing multiple copies of a design).

As far as I know, however, none of the current versions of Ada (even the 16-bit implementations) offer generics. To complicate the problem, the DoD recently redefined the procedures for handling random-access files. It seems that we can expect a year or two of daffy anarchy before the dust settles in this area of Ada.

IO.LIB contains the Janus routines for creating, reading, writing, deleting, and otherwise manipulating disk files. Other peripheral devices—the CP/M CON: and LST: devices, for instance—are also recognized. The procedures in IO.LIB, although not "standard," look enough like those in the Ada Reference Manual to be fairly portable. The current version of Janus (release 1.4.3) does not support random access I/O, although the people at RR assure me that that is one of their priorities.

One beautiful thing about text I/O in Janus is that *get* and *put* have been extended to work with Booleans and enumeration values. (Since this feature depends on instantiation of generic packages in standard Ada we won't be seeing it in other versions of the language for some time.) To illustrate, the statements

```
type PHILOSOPHY is (ROMANTICISM,
                    IDEALISM,
                    NARROW_MINDEDNESS);
BELIEF_SYSTEM:  PHILOSOPHY;
TRUTHFUL:       Boolean := true;
    ...

BELIEF_SYSTEM := NARROW_MINDEDNESS;
put (BELIEF_SYSTEM);
put (" is ");
put (not TRUTHFUL);
```

would print

```
NARROW_MINDEDNESS is FALSE
```

This is a really good feature (sadly missing in Pascal) which I intend to use frequently.

Omissions

There are a couple of omissions in Janus. Real numbers and multi-dimensional arrays are not supported as of this writing, although both should be available by the time you read this. The only important feature of Ada found in the Supersoft compiler and not in Janus is overloading of procedures and functions. The people at RR inform me that overloading is being contemplated for a future release.

So, for now at least, the jury is in—Janus encompasses at least five times as much of Ada as Supersoft, including many of the more exotic features of the language. Janus is a really useful tool, especially for systems programmers and people who wish to get a head start on learning Ada (you will learn little about Ada from the Supersoft product).

The Janus package provides nearly four times as much software (including the compiler, an 8080 assembler, a disassembler, the support libraries, and fully-documented run-time source code) as Supersoft for about $50 more.

I will leave to you the decision of which product to buy. □

Ada Errata

The author has found a few bugs in the previous two installments of "The Countess and the Computer Language."

In Part One (November), Page 192, top right column, the test "if MEEKNESS in ADA_QUALITIES" would produce a type error when compiled. To make this test legal, ADA_QUALITIES would have to be declared as a subtype of another enumeration type that had MEEKNESS as a possible value.

At the bottom of the same column, the declaration "PERIMETER: SIDES * LENGTH_UNIT;" is also illegal. The problem is that a constraint parameter (SIDES in this example) can be used only in declarations of arrays. The correct line is "PERIMETER: array (SIDES) of integer;".

In Part Two (December), Page 219, column 1, the line "procedure SQUARESUM (X: in integer;" should read "procedure SQUARESUM(X:in out integer;". The "out" specification allows the next assignment statement to work properly.

Near the end of that installment, the statement "use FREDS_IO_PACKAGE, SALLYS_IO_PACKAGE;" should be removed. This statement would cause confusion for subsequent "put" statements.

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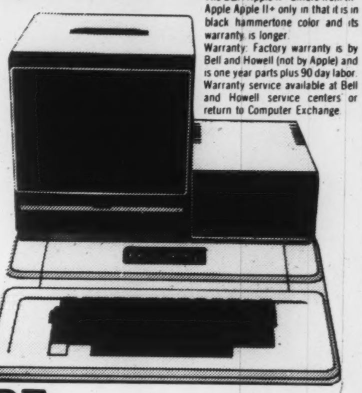

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A Structured Graphics Language

Ed Jackson

The best thing I can say about *Ceemac* is that I never bought a piece of software for so little that was worth so much. It is not easy to find. You just have to run across an ad. Brooke Boering, the author, is operating on a shoestring at this time. His ads are one inch classifieds.

How then, you might ask, did I happen to buy *Ceemac*? Well, Mr. Boering had a marketing idea that was a combination of sheer genius and audacity. He made a demo disk of the kind of graphics that *Ceemac* is capable of creating, supplied it to computer stores, and asked them to give copies free to their customers. That was my introduction to *Ceemac*.

I was enchanted with that demo and would have paid the $40 he asks for *Ceemac*, for the demonstration disk alone. The demo disk holds 35 *scores*, as the author calls his programs. At the touch of a key, the display changes from one dazzling display to another. On disk you find a series of programs which describe the various scores; the company, Vagabondo Enterprises; and Arthur, the language with which these text programs were created.

For your $40, you get a diskette and a manual—not a tutorial, but a manual. It suggests that you take one of the many demonstrations and experiment with it—learn by doing.

Ceemac is not a utility to aid you in the creation of hi-res graphics using the standard Apple commands. It is a stand alone language complete with pre-defined variables, macros, line editor, commands, and error messages. It is a structured language. You do not enter program line numbers. (Nor does *Ceemac*. There *are* no line numbers.)

It points out syntax errors by placing the cursor at the beginning of the blunder, and beeping *once*. If the editor cannot detect the error until execution, it immediately lists the program, gives an error message, and places a prompt on the offending line.

creative computing

SOFTWARE PROFILE

Name: Ceemac
Type: Graphics art
System: 48K Apple, DOS 3.3
Format: Disk
Summary: Incredible, and a bargain.
Price: $40.
Manufacturer:
Vagabondo Enterprises
1300 E. Algonquin - 38
Schaumburg, IL 60195

Using The Program

What you create is not always what you set out to create, but it is always stunning in its beauty and speed of execution. You can make a paddle control the speed, or make it control a variable. You can use the buttons to start fresh, to change the color of your drawings, or to change the background color. These changes occur very rapidly.

Editing possibilities include upward and downward scrolling, list from the top, delete, replace, insert, or edit a line. All of these commands are started with only one key.

The only control characters are control-a for moving from edit to execution, and control-c to move to DOS mode.

If you are familiar with Applesoft, some of the commands will seem familiar. These include GOTO, GOSUB, FOR, and AGAIN. If you forget, type NEXT, the editor forgives you and immediately replaces it with AGAIN. Commands that are different from Applesoft and Integer are nupool, rndcol, nxtcol, spline, forcel, adot, and setasp. Among the things you can do with these commands are: set the symmetry of the pattern, setup a ratio between x and y coordinates, set xscale and yscale and rotation, and draw shapes. *Ceemac* does not have a shape generator. There are, however, instructions for creating shape tables.

There are also many commands unique to *Ceemac*. For instance, "sky," gives you a sky, complete with number of stars you want, in any color you want, instant-

---

Ed Jackson, 4100 Fairlane, Fort Worth, TX 76119.

ly. And "abox" draws boxes, rectangular or square.

You can create sounds with *Ceemac* or have music from your cassette control the graphics. You also have a "trace" function, and the command that I think is the cleverest of all, is. If you type x1 = x1 % 5, x1 will increment itself to the edge of the screen and then *decrement* itself back down. And vice versa.

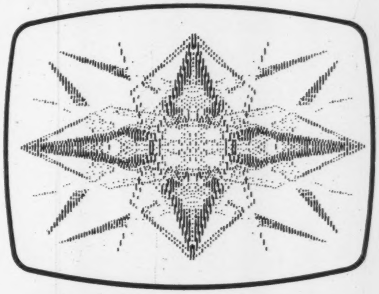
Another great feature is the printer option. By keying in shift/printer slot, you can print out your own scores, or the ones on disk to study. You can also get hard copy from any of the text files.

I believe that the manual was not designed as a tutorial for three reasons: one, Mr. Boering wants you to experience the thrill of discovery and the joy of accomplishment; two, a tutorial which fully explained all the possibilities of *Ceemac* would probably put the cost of production out of the shoestring category; and three, *too* detailed explanations would stifle your creative and experimental instincts. I believe that the limitations you encounter will be your own, not *Ceemac's*.

About The Author

I could fill many more paragraphs with more features, but I prefer to close this with a word about Mr. Boering. When I ordered *Ceemac*, I said that I hoped it was user-friendly as I was pretty dumb. You can imagine my surprise when I got my check back with a personal letter from Mr. Boering, saying that *Ceemac* was not for everyone, and that it took some understanding of programming techniques to use. I quickly re-ordered, thanking him for his concern, and quite quickly received my disk and yet another very kind letter.

Ceemac is a fine disk for learning and enjoyment. It sets a very fine example of excellent programming, business ethics, and advertising that larger companies would be wise to imitate. ☐



Sample output from a Ceemac *program.*

Figure 1. Sample Ceemac *program from the demo disk.*

```
SCORE: KL-LORI AT HER BEST

:
: INITIALIZE
:
CLEAR [0;0]
SPEED [0;0]
V1 = 5
:     V1 PATTERN'S DEPTH
:
V4 = 7
:     V4 = SYMMETRY
:
: MAIN CHAIN
:
F
: FLIP COLOR OF PATTERNS ON SCREEN
PULSE [1;0]
:
: SET COLOR OF NEXT PATTERN
COLOR = NXTCOL
:
: SET START POINTS OF NEXT PATTERN
XY1 = RANDOM;RANDOM
X2 = $80
:
:
: DRAW PTRN ERACE AFTER 6TH PTRN
FOR V1
  BLINE [0;V4]
  BRASE [$1E;0]
  Y2 = Y2 + V1
AGAIN
CEEMAC  REL 1.0
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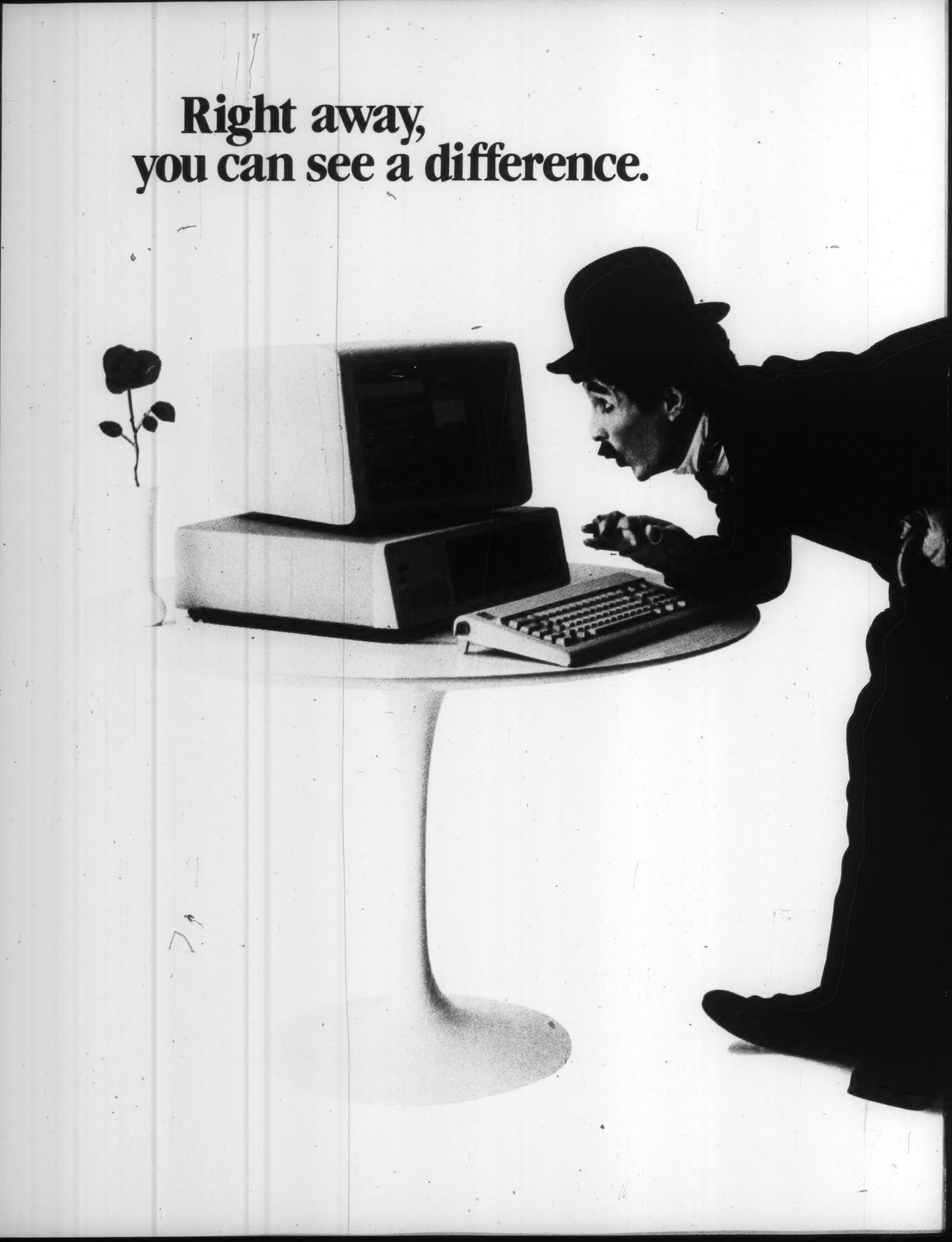
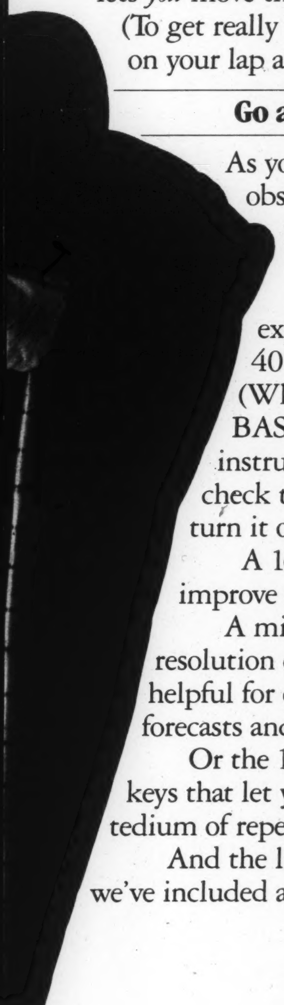
CIRCLE 165 ON READER SERVICE CARD


Right away,
you can see a difference.



Stop in a store near you. Take a look.

You'll be instantly taken with some of the features that make the IBM Personal Computer so different.

Like the non-glare screen—easy on the eyes during those number-crunching tasks like payroll and general ledger.

80 characters a line—with upper and lower case letters for a quick and easy read.

And the flexibility of a system that lets *you* move the components around at will. (To get really comfortable, try the keyboard on your lap and put your feet up.)

Go ahead, compare.

As you progress from casual observer to comparison shopper, you'll want the inside story of the IBM Personal Computer.

Like user memory expandable up to 512KB. And 40 KB of permanent memory. (Which not only includes the BASIC language, but diagnostic instructions that automatically check the system every time you turn it on.)

A 16-bit microprocessor that can improve speed and productivity.

A mix of crisp text and high-resolution color graphics—clearly helpful for creating charts that target forecasts and trends.

Or the 10 programmable function keys that let you bid goodbye to the tedium of repetitive tasks.

And the list goes on. Which is why we've included a box (at right) that tells all.

There's more than meets the eye.

Some of the best things about the IBM Personal Computer aren't part of the computer.

Like the instruction manuals that help you set up our system and teach you to use it with the greatest of ease.

IBM PERSONAL COMPUTER SPECIFICATIONS

User Memory
16K-512K bytes*
Microprocessor
16-bit, 8088*
Auxiliary Memory
2 optional internal diskette drives, 5¼", 160K bytes or 320K bytes per diskette
Keyboard
83 keys, 6 ft. cord attaches to system unit*
10 function keys*
10-key numeric pad
Tactile feedback*
Diagnostics
Power-on self testing
Parity checking*

Display Screen
High-resolution*
80 characters x 25 lines
Upper and lower case
Green phosphor screen*
Operating Systems
DOS, UCSD p-System, CP/M-86†
Languages
BASIC, Pascal, FORTRAN, MACRO Assembler, COBOL
Printer
Bidirectional*
80 characters/second
12 character styles, up to 132 characters/line*
9 x 9 character matrix*

Permanent Memory
(ROM) 40K bytes*
Color/Graphics
Text mode:
16 colors*
256 characters and symbols in ROM*
Graphics mode:
4-color resolution: 320h x 200v*
Black & white resolution: 640h x 200v*
Simultaneous graphics & text capability*
Communications
RS-232-C interface
Asynchronous (start/stop) protocol
Up to 9600 bits per second

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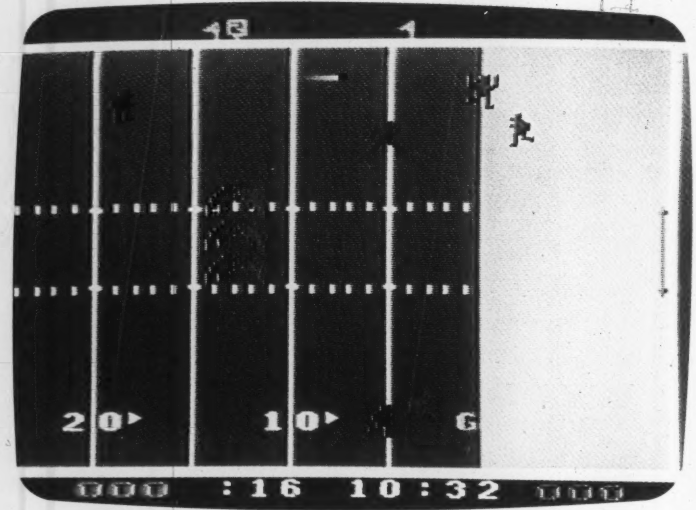
CIRCLE 184 ON READER SERVICE CARD

This Sunday You Can Play Football Against Your ATARI® 400/800™



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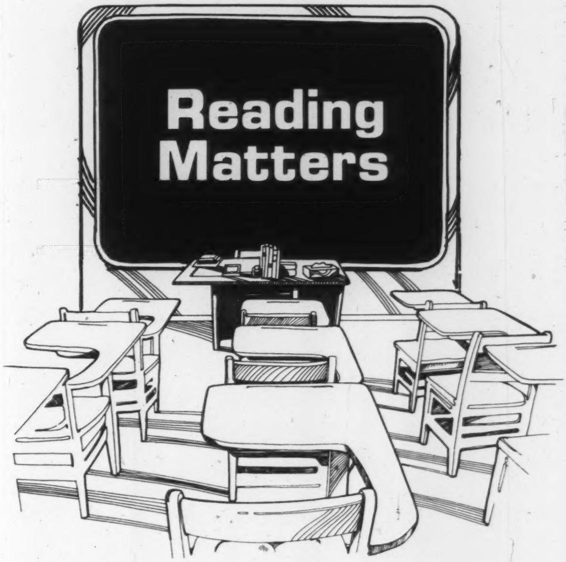
CIRCLE 175 ON READER SERVICE CARD

creative computing software evaluation



Reading Matters

Bud Stolker

Rising above the glut of "me-too" game programs for the Atari home computers announced at the West Coast Computer Faire last spring is a self-improvement program called *SpeedRead+*. It is a serious attempt to help users boost their reading speed and comprehension by using well designed eye training exercises.

The principle behind *SpeedRead+* is a simple one. If you can train yourself to concentrate on reading text efficiently, you will save time, understand more of what you read, and feel less tired at the end of a long reading session.

To help users achieve these goals, the publisher, Optimized Systems Software, provides a machine language program that flashes words and phrases on the TV screen at speeds from five to five thousand words per minute. Three literary classics are included as text files with the program: Washington Irving's "Rip Van Winkle" and "Legend of Sleepy Hollow," and Bret Harte's "Outcasts of Poker Flat."

Easy to Use

Each eye training exercise is accompanied by tips on how to use it to best advantage. Once an exercise is selected, the user can control both the display speed and the width of the text window by using either the keyboard or the Atari joystick—a nice touch. An option menu and display of the current reading rate are always just a keystroke away.

SpeedRead+ starts by loading the text of your choice into memory, automatically using all the space available. It counts every word of text, so that you can start a session by specifying the very spot at which you left off last time.

creative computing

SOFTWARE PROFILE

Name: SpeedRead+

Type: Self-improvement program

System: 16K Atari 400 or 800,
16K Apple II

Format: Disk

Language: Machine

Summary: Useful tool for developing good reading habits and increasing comprehension

Price: $59.95

Manufacturer:
Optimized Systems Software, Inc.
10379 Lansdale Ave.
Cupertino, CA 95014
(408) 446-3099

The words flash by on the screen, centered under a stationary dot that gives the eyes an anchor in the vast expanse of the video display. The idea is to hold your eyes steady, letting you absorb the information without backtracking or "tuning out." As you feel more confident with the exercise, you can select wider phrase modes (up to 38 characters, nearly the width of the Atari display) to broaden peripheral vision, or you can increase the display speed—or both.

Several Ways to Train the Eyes

From here the alternatives vary, depending on individual needs. A "double phrase mode" displays text alternately on the left and right sides of the screen. This exercise trains your eyes to jump to a predetermined point and instantly recognize the phrases. It also develops the timing and rhythm necessary to read printed text efficiently.

A "random phrase mode" displays text anywhere on the screen, although the user can select the approximate distance from the central stationary dot. The purpose of this mode is to expand peripheral vision, an essential element in speed reading. I found that it took some practice to keep my eyes glued to the dot and still comprehend the text flashing on the screen.

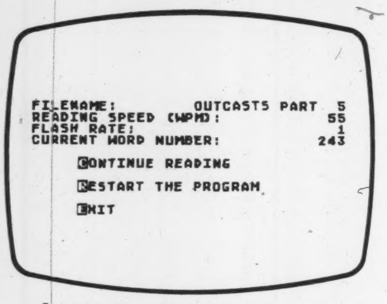
Bud Stolker, Landmark Towers, Apt. 1506, 101 S. Whiting St., Alexandria, VA 22304.

The "column phrase mode" most closely approximates the kind of reading we all do once we tear ourselves away from the computer. This exercise trains the eyes to travel from top to bottom of a column of text, stopping only once per line and focusing at the center of each line.

The program displays each column for a predetermined number of seconds, then replaces it with more text. By pulling forward or backward on the joystick, I was able to synchronize the speed so that the text changed just as my eyes hit the bottom line of the column.

Method Used In World War II

SpeedRead+ is an updated version of the old tachistoscope, a mechanical device that presents visual material for brief periods of time. During World War II, naval aircraft spotters were trained to differentiate friend from foe based on images flashed by tachistoscopes equipped with mechanical shutters. The technique was highly successful. But when they used the machine for character and word recognition, researchers found that average reading rate gains were unimpressive (though some people achieved spectacular gains). To this day the effectiveness of the tachistoscope is an item of controversy. Because *SpeedRead+* is essentially a computerized tachistoscope, it must be evaluated with caution.



```
FILENAME:            OUTCASTS PART 5
READING SPEED (WPM):              55
FLASH RATE:                        1
CURRENT WORD NUMBER:             243

      CONTINUE READING

      RESTART THE PROGRAM

      EXIT
```

Intermediate SpeedRead+ menu.

Shortcomings

The program makes no attempt to break the text into meaningful phrases; it simply calculates how many words it can display at a time and considers that a phrase. This hinders its ability to boost true phrase recognition and overall comprehension.

While it would have been possible to mark appropriate phrases in the text (by setting the high-order bit of the first character as a flag, for example), this would have entailed a great deal of work, would have raised the cost of the software considerably, and would not have solved the problem of marking user-supplied text.

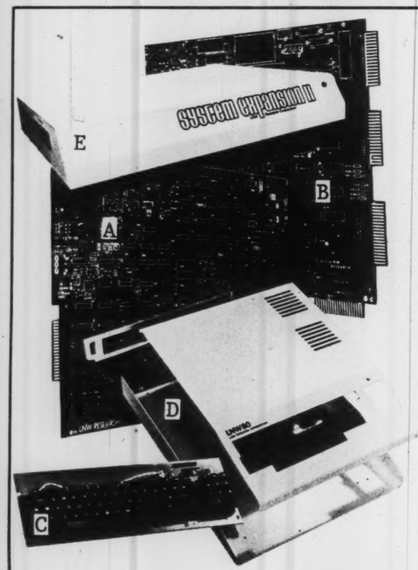
There are other problems, too. For one thing, the three texts are supplied entirely in upper case. When was the last time you read a book printed in all capital letters? Author Zeissman claims that it is easier to recognize words when they are capitalized. I was taught just the opposite in college design classes. He may be right in the case of the Atari, however. Its lower-case character set is so—well, so *whimsical*—that it could interfere with rapid comprehension.

Why Bret Harte?

The choice of texts puzzles me as well. While Bret Harte and Washington Irving are colorful authors, they hardly typify the standard fare of today's readers. Their styles and vocabularies are somewhat dated, and they appeal, I suspect, to a limited audience. I would have preferred to see the *SpeedRead+* manual included on disk so that I could have absorbed it for practice.

Once you have read Harte and Irving a few times, of course, you know every twist in the plots, and I found a tendency to let my mind wander when I should

COMPUTER KITS – FROM $69.95



LNW SEMI-KITS can save you hundreds of dollars. By obtaining your own parts at the lowest possible cost and assembling the **LNW SEMI-KITS**, you can have the most highly acclaimed microcomputer in the industry – the **LNW80**. The **LNW SEMI-KITS** are affordable modules. You can start with a modest cassette system and expand to a full 4Mhz TRS-80 compatible system with 5 or 8 inch double density disks and color at any time.

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VISA and **MasterCard** accepted. Add $3.00 for shipping plus $1.00 for each additional item. All shipments via UPS surface. Add $2.00 for U.S. Mail. Shipments outside continental U.S.: funds must be U.S. dollars. Sufficient shipping costs must be included with payment.

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CIRCLE 115 ON READER SERVICE CARD

Videx INC. T.M.

Videx, a frontrunner in microcomputer peripherals and software, announces two exciting new programs that will make existing software compatible with the 80-column VIDEX VIDEOTERM.

NEC
apple][
disk II

APPLE WRITER][

pre-boot with 80-Column Display

This program allows an 80-column display for your APPLE WRITER][, and access to true upper and lower case input from the keyboard. When combined with the ENHANCER][, this program will provide a complete word processing package.

Interested in word processing in different languages? The pre-boot program has been set up to allow APPLE WRITER][to prompt in other languages. With an Enhancer][, the keyboard can be programmed to be compatible with different languages.

$19.00
Suggested retail price

NEC
apple][
disk II

VisiCalc™

pre-boot with 80-Column Display

Now you can view the VisiCalc electronic worksheet window in 80 columns. Since the entry line is also 80 columns wide, complex formulas can now be seen in their entirety for editing ease. An added bonus is the ability to display upper and lower case.

$49.00
Suggested retail price

For those who need even more power, a more advanced version combines all the above features with the ability to use many of the memory expansion boards currently available. A configuration editor allows VisiCalc to use a mixture of different kinds of memory expansion cards. Just tell it what memory cards you have and which slots they are in. For example, you could use more than one language card equivalent. The memory cards can be combined to give you access up to 176 K of memory!

$89.00
Suggested retail price

897 N.W. Grant Ave. • Corvallis, Oregon 97330 • 503/758-0521

CIRCLE 284 ON READER SERVICE CARD

MING CHALLENGES YOU TO SURVIVE!

MING'S
challenge

Ming... Evil incarnate, a hellish entity who by comparison makes Hitler, Stalin, Tiberius, Torquemada, Ivan the Terrible, and the Devil himself look like candystripers... challenges YOU to survive! Think it's easy? Consider:

- You sit, fingering the *kill* button, in your small spaceship at the bottom of the screen.
- Suddenly Ming directs Deathships straight at your fragile craft.
- Next the Claymen, at a signal from Ming, hurtle bombs at you.
- You can neutralize Ming's Deathships by shooting them and placing them in suspended animation.
- Cyclops drop bombs on you and freeze the Deathships, making them disappear into hyperspace (making you lose points).
- If you do not place Deathships into suspended animation they will vanish into the Black Hole and you will lose points.
- Greater perils and varying challenges await you and only the truly TOP game players will survive MING'S CHALLENGE.

As a player, you enjoy the option of altering the parameters endlessly... changing speed of the game, number of enemies, width and depth of the Black Hole. Also, if you are the first to survive MING'S CHALLENGE, you will receive either the next 10 games produced by MICROFUN, free of charge, or any single business product presently available from MICROLAB.

This Program was Written by Mike Livesay
Available now at your local dealer
CIRCLE 215 ON READER SERVICE CARD

micro fun™
entertainment division
of micro lab

MING'S CHALLENGE plays on
Apple II, 48K

APPLE is a registered trademark of Apple Computer, Inc

have been concentrating. The author has thoughtfully provided an explanation of how to create new text files using any Atari-compatible text editor (or the Assembler cartridge). A good way to acquire lots of text is to pull it in over the phone lines from a remote system like the Source or Compuserve.

Classroom Use Encouraged

Along with *SpeedRead+* and the text files, OSS includes the framework for an examination program that lets teachers prepare computerized multiple choice tests. The exam system, which includes automatic score keeping, is designed to check students' comprehension levels. Each exam may have up to 255 questions.

The sample test is sketchy indeed, and I couldn't help wishing it had been based on "Outcasts of Poker Flat," a relatively unknown work to many students (and to me). It is probably asking too much of a teacher to make up a computerized exam for each text covered in class, but a school system with several Ataris might use the comprehension exams to advantage.

I suspect *SpeedRead+* will find its way into more homes than classrooms, since it is best used on a regular basis in a quiet place, rather than for a week or two at a time at school.

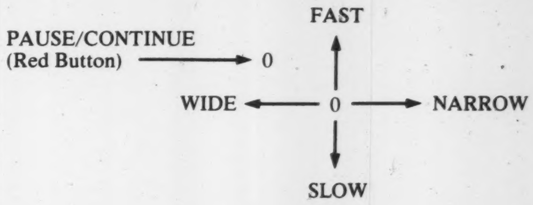
I found *SpeedRead+* a practical and useful tool. The morning paper has always been my nemesis; a careful reading takes as much as an hour a day. By using *SpeedRead+* as an exerciser, I have raised my comprehension level (though without, alas, cutting my reading time). The improvement may be due to the constant reminders in the manual to concentrate while reading, rather than to any improvement in eye movement or phrase recognition. At any rate (pun intended), I am enjoying my reading more now, and I am convinced that *SpeedRead+* has contributed to my pleasure.

Good Manual and User Support

Optimized Systems Software provides an excellent 25-page manual that explains the theory behind each exercise, outlines sample exercise sessions, and gives simple start-up instructions for first-timers too impatient to read the whole manual. The two disks come with a strongly worded licensing agreement.

OSS has an excellent reputation for support of its Atari operating system and Basic upgrades, and can be expected to stand behind this product. They do promise telephone support, though I was unable to find any significant bugs.

There is a hint also of future updates at reduced rates (or no charge) to licensed users. OSS released the Apple disk version of *SpeedRead+* in May, and they hope to have disk versions available soon for the TRS-80 and IBM PC.



Keyboard commands can be initiated from Atari joystick controller.

This program is a welcome reminder that home computers can be much more than game machines. I would like to see more personal development tools of this caliber. *SpeedRead+* has much to recommend it, and I do so without hesitation. ☐

FIRST and FINEST

In Systems Software for Atari® and Apple®

MAC/65

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Then we produced our enhanced "EASMD."

Now OSS is introducing the **finest** integrated assembly language development system yet!

In addition to being ideal for writing small, "quick and dirty" subroutines and programs, **MAC 65** shows its full power and speed when used with even the most complex of large assembly language source files

Naturally, **MAC 65** is upward compatible with both EASMD and the Atari cartridge. And, of course, the object code output is also compatible with OS A+, Atari DOS, and or Apple DOS, as appropriate.

MAC 65 .... **$80.00***

OS/A+

Optimized Systems Software — the group that produced **both** the **first** Apple DOS **and** the **first** Atari DOS — now brings you OS/A+, which combines the **finest** features of these and other successful personal computer operating systems.

OS/A+ is the **first** and **finest** operating system available for **both** Apple II and Atari computers and features a keyboard-driven, easy-to-use command processor. In addition to several simple resident commands, OS/A+ allows logical and readable requests for even the most sophisticated utility commands. In fact, the user can even add system commands as desired.

But the real power and flexibility of OS/A+ is its ability to easily interface to devices and **disk drives** of virtually any kind and size. File compatibility (with Apple DOS or Atari DOS, as appropriate), device independence, batch processing, easy of use — OS/A+ truly brings the **finest** in operating systems to **your** computer.

AND NOW OS/A+ (for standard Atari or Apple drives) is included as a part of **every** standard OSS language package. Versions of OS/A+ for some higher capacity drives available at extra cost.

Unless otherwise noted, all OSS products require 48K and at least one disk drive. We recommend 64K for the Apple version of OS/A+.

SpeedRead+

The **first** and still **finest** speed reading tutor designed for **you** to use on **your** computer is available **only** from OSS.

SpeedRead+ uses time-proven techniques to train **you** to instantly recognize words and phrases, and yet it goes far beyond what mere mechanical devices are capable of.

SpeedRead+ exercises your peripheral vision, improves your eye movement and timing, and generally works **with you** at your pace... now and in the future.

NOTE: The Atari version of SpeedRead+ needs only 16K of RAM

SpeedRead+ **$59.95**

tiny C

As a product of Tiny C Associates, **tiny-c** was the **first** structured language interpreter for microcomputers. Now OSS brings this innovative interpretive language to **your** home computer. While not having the speed and power a true **C** compiler, **tiny-c** is an excellent choice for the programming student who is ready to begin learning the valuable techniques of structured languages.

tiny-c provides an easy-to-use, easy-to-modify environment that encourages experimentation while promoting proper programming style. The **tiny-c** package includes not only a comprehensive and instructional user manual but also **complete source**.

tiny-c **$99.95***

C/65

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The **first** native mode **C** compiler ever produced for Atari **and** Apple computers.

C/65 supports a very usable subset of the extremely powerful and popular **C** language. Just as **C** is used by the most sophisticated programmers from the professional and academic communities, so shall **C/65** prove to be a powerful and much-needed tool for 6502 software developers.

C/65 supports integer and character types (and arrays), pointers, fully recursive functions, and much more.

NOTE: C/65 requires MAC/65 or an equivalent assembler. Two disk drives recommended but not required

C/65 .... **$80.00***

TRADE UP

Trade up from Atari's Microsoft Basic to **BASIC A+** and receive a **$15 discount**. Call or write for details.

BASIC A+

"From the authors of Atari BASIC..."

It's a fact! OSS gave you that **first** and **most popular** language for Atari Home Computers. But why be content with the **first** when you can have the **finest**?

BASIC A+ is the **only** logical upgrade available to the Atari BASIC programmer. While retaining **all** the features which make Atari BASIC so easy to use, we've **also** given BASIC A+ features that place it at the forefront of modern interpretive languages. BASIC A+ will let **you** explore the worlds of structured programming, superior input/output, helpful programming aids, and even a very comprehensive PRINT USING command. **And**, exclusively for the Atari computer, an almost unbelievable array of PLAYER/MISSILE GRAPHICS commands and functions.

BASIC A+ **$80.00***

***REMEMBER**: Standard OS/A+ is **included** at no extra charge with BASIC A+, MAC/65, C/65, and tiny-c.

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Optimized Systems Software, Inc.,
10379 Lansdale Ave., Cupertino, CA 95014, (408) 446-3099

CIRCLE 222 ON READER SERVICE CARD

Assimilation Aid

Brian Murphy

E-Z Learner came across my desk at the crucial moment — just as I was about to undertake the life-or-death task of learning enough French to keep from starving to death on my first visit to Paris.

Nothing, they say, brings out the good veal like a few compliments on the restaurant's decor when phrased elegantly in French. Unfortunately, though my grasp of grammar is good, my vocabulary as of the time I received *E-Z Learner* was, shall we say, limited.

Setting aside my worries about starving in the culinary capital of the planet, I looked at the brochure which comes with the program. Silicon Valley Systems makes no elaborate claims about this software. They say that the program is simple to use, that it will help you to assimilate large amounts of information and that it will enable you to *learn* the information, rather than merely memorize it for the short term.

I brought all my French manuals together, dumped them beside my Apple II, and booted up *E-Z Learner*. I saw on my monitor a menu and the directive to hit the space bar for instructions, which explained what the nine menu commands did. In about five minutes I was ready to create my first file.

I found out very quickly that what I was about to create was a set of electronic flash cards, which I could tailor to my own needs, including only information I needed. I titled my first file "French Vocabulatory" and plunged ahead.

On screen there were now two blank flash cards. By adding an ! before my entry, I could alter the format to center my question at the top of the card, so I wrote "!un verre." Beneath that I typed "!a drinking glass." I repeated the process about a dozen more times, adding words with which I would need to be familiar and their translations, and then hit control-S to stop.

creative computing

SOFTWARE PROFILE

Name: E-Z Learner

Type: Teaching program

System: 48K Apple II, disk drive with 3.3 DOS

Format: Disk

Language: Machine language

Summary: Effective self-teaching tool

Price: $39.95

Manufacturer:

Silicon Valley Systems
1625 El Camino Real, #4
Belmont, CA 94002

That command brought me to the first menu for the actual flash card "power review," where I had the options of having the questions put in the original order (the question in French and my translation in English) or in reverse order (with the question in English and me attempting to come up with the answer in French).

Having selected the original order, I landed in a new menu, which offered me the option to start or continue the review, start over (which lands you back in the menu where you decide whether you are asked the question or the answer first), or return to the main program menu. After a brief monitor display indicating that the order of questions was being randomized, the first question came up.

Perfectly centered at the top of the flash card was "un verre." The on screen prompt said to press the space bar for the answer. Attempting to type the answer didn't even make the cursor blink. So I intoned "a drinking glass," hit the space bar and the answer came up, "a drinking glass." A triumph! In order to get the next question I had to type C if I was right or W if I was wrong. I typed C and the next question came up.

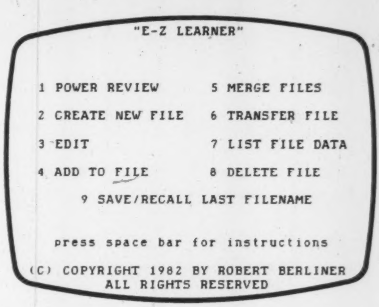
I completed all twelve questions, and

Brian J. Murphy, 133 Post Road, Fairfield, CT 06430.

my monitor informed me that after one review I had eleven right and one wrong. The menu option to start or continue the review brought me back to the question I had wrong. I got it wrong again. The same menu option landed me back on that same question and would continue to do so, I surmised, until I got it right. Once I did, I had the option of starting the review over from the top or going to the main menu.

Did it work? Was I able to expand my vocabulary? The answer is yes. Using the technique of reviewing previously entered questions and then adding new questions to the file daily, I was soon able to translate quickly and accurately ever-increasing amounts of vocabulary. The material stuck with me. I was able to use my new vocabulary in formulating sentences and phrases. I had, as the documentation promised, not merely memorized but *learned*.

This program is perfectly adapted for home use by students who have a great deal of material to learn. I recall, with horror, some of the rote learning I had to do in high school and college. An Apple II with *E-Z Learning* would have been a godsend in those days, as I memorized the steps in the process of cellular mitosis and important dates in U.S. history. Not all learning, after all, is of concepts.



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                "E-Z LEARNER"

 1 POWER REVIEW         5 MERGE FILES
 2 CREATE NEW FILE      6 TRANSFER FILE
 3 EDIT                 7 LIST FILE DATA
 4 ADD TO FILE          8 DELETE FILE
        9 SAVE/RECALL LAST FILENAME

      press space bar for instructions

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```

The home user from grade 6 up will have no difficulties using *E-Z Learner*. The instructions are clearly phrased, the prompts are simple to follow and the program offers real flexibility in creating files.

This program is perfectly adapted for home use by students.

Files are saved on work disks, which means that you can have an unlimited number for future reference and review. Notes transcribed into flash card form on these files can be stored indefinitely and could be a real bonus at final exam time, or when preparing for SAT or GSAT placement tests.

The program enables you to take files and transfer them to disks or to merge them, so that, in a final exam situation, for example, you can take the material you have studied unit by unit and review it as a whole. At any time you can delete a file or, if you have made a mistake, edit individual questions to add, delete, or correct information. Once a file is created, it can be expanded at any time with new questions, the only limit being the storage capacity of your disk.

Teachers interested in using this program in the classroom should note that the program is not really suited for unsupervised review. The program will believe the child if he says he got all the answers right. For students who want to review, for their own benefit, material for examinations or quizzes, the program is ideal, since the file can be tailored to meet the students' exact needs.

The documentation says the program is menu driven, but it is also motivation driven. If you want to learn, then *E-Z Learner* is a perfect tool for the job. ☐

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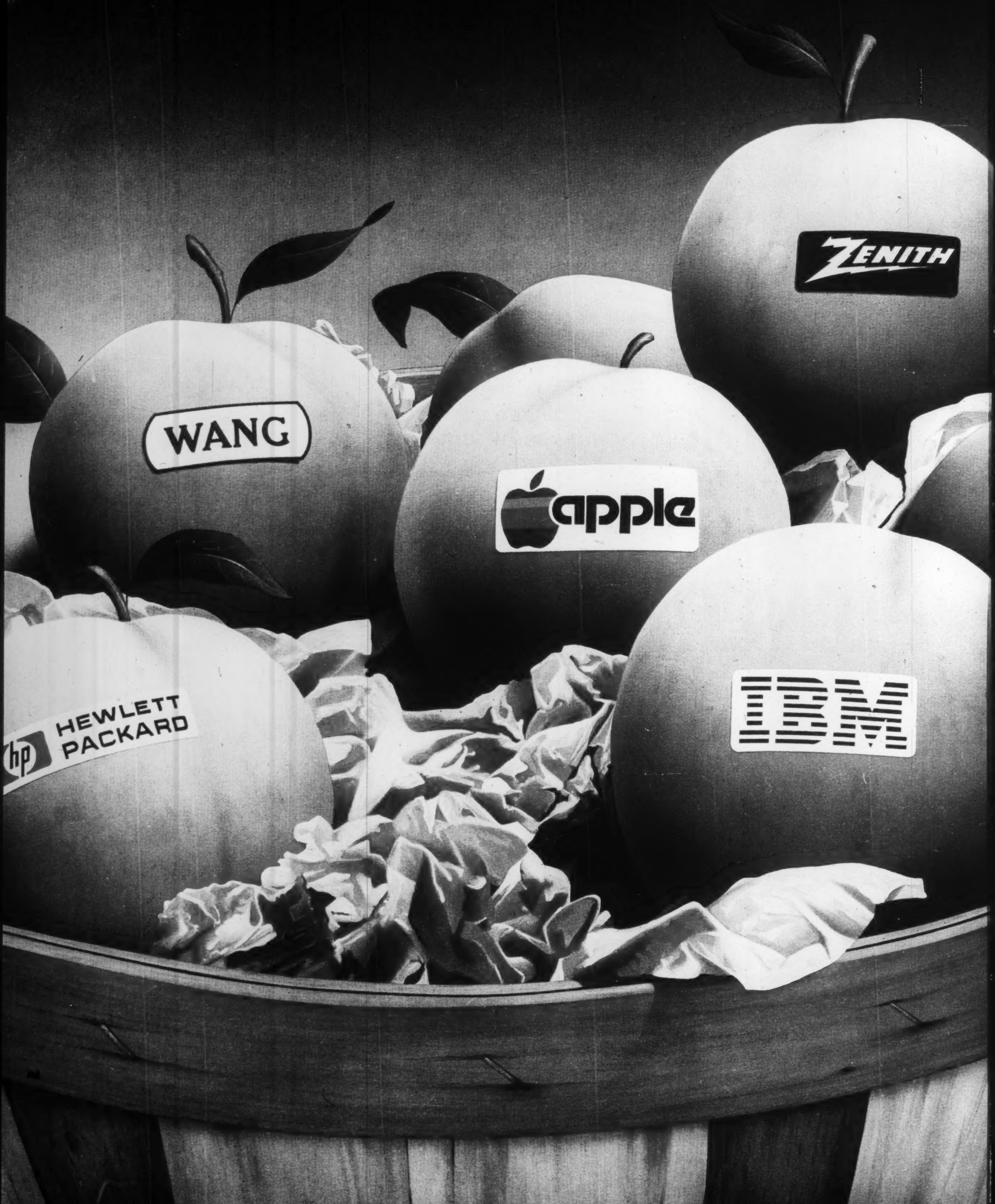
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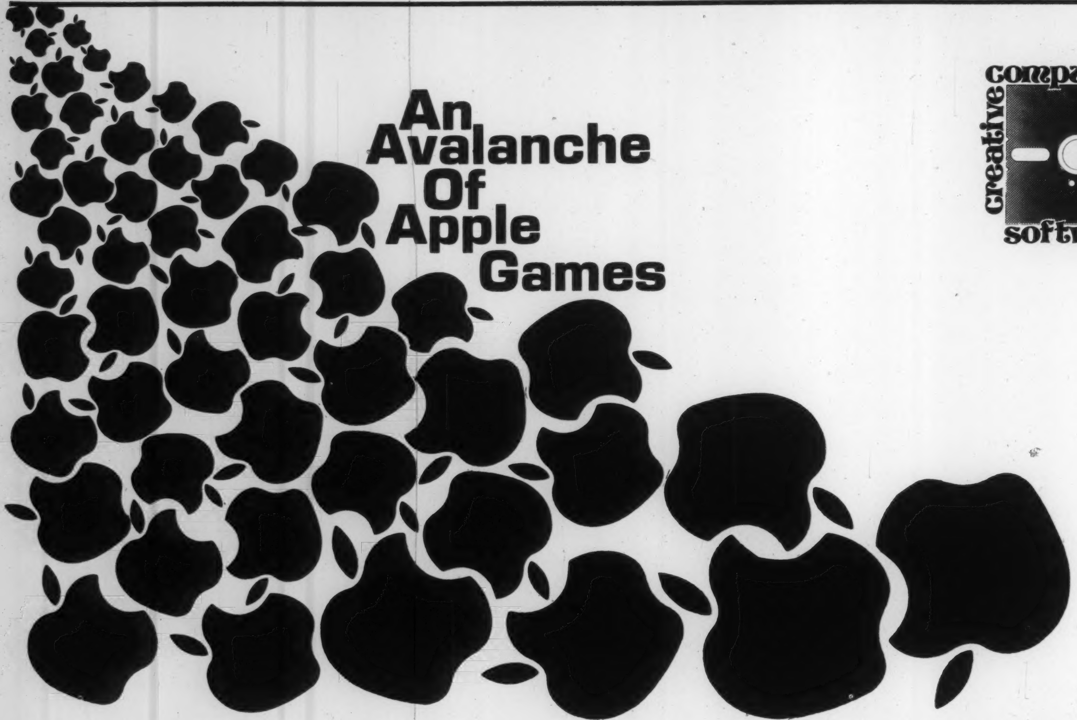


An Avalanche Of Apple Games

David H. Ahl
Randi J. Rost
Dan Jacobs
Chris Vogeli

There's no rest for the weary, and also no rest for the avid Apple-gamer. So many high quality games have been introduced in the past several months that it's hard to keep up with them all. In our effort to keep you up to date, here are some of our findings.

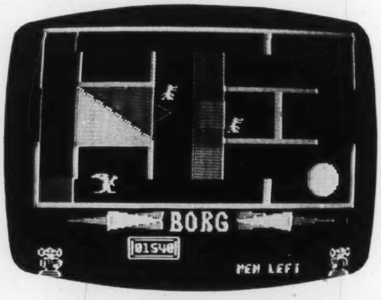
Borg

No, *Borg* is not a Wimbledon simulation in which you attempt to win six straight championships. Rather, it is a superior game in the class that included Datamost's *Thief* and the popular arcade game *Berzerk.* In *Borg,* your mission is to reach The Grud, destroy him and then escape. In order to accomplish this you must navigate through 10 rooms, avoiding dragons and a kangaroo with wings named Borg.

In the first room, the dragons are unarmed; in all subsequent rooms, they have weapons and are intent on putting you out of your misery. Luckily, dragons are by nature dull-witted (you knew that, right?) and will sometimes shoot each other or collide. One must also be wary of the objects in each room, since some are electrified and will cause a quick demise at the slightest touch. If that weren't enough, there's still the small matter of Borg to contend with.

Borg appears just about the time you are getting things under control. You are making for the exit, intent on vaporizing the last couple of dragons when an ominous call for "Borg!" rattles your Apple's speaker. Out hops Borg, straight toward you, crashing through everyone and everything in his way. If he reaches you before you reach the exit, it's goodbye, Charlie.

The rooms themselves are excellent examples of Apple hi-res graphics. The quilt room is typical: patches of color are laid out in a pattern pleasing to the eye, but devilishly tricky to navigate. The figure of a man that you are controlling can run and fire his weapon in eight directions, and the animation is remarkable for a shape so small.



A menu at the start of the program lets you choose which control to use. Options include using either game paddle, a joystick, an Atari joystick connected to a Sirius Joyport, or keyboard controls. I found the Atari joystick made to order for *Borg.* During the game, you can toggle sound effects on or off with CTR1-S or restart the game by pressing CTR1-R.

Hitting the ESC key causes the game to pause so you can answer the phone or

creative computing
SOFTWARE PROFILE

Name: Borg
Type: Arcade game
System: 48K Apple II, II+
Format: Disk
Language: Machine
Summary: Great graphics and action
Price: $29.95
Manufacturer:
Sirius Software
10364 Rockingham Dr.
Sacramento, CA 95827

Randi Rost, 1405 Woodland Ave., Fairmount, MN 56031.

Dan Jacobs, 4509 Dartmouth Ave., Sacramento, CA 95841.

THIS GAME'S GOT BUGS

But you'll LOVE them

PEST PATROL
SIERRA

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PEST PATROL is another fine HI-RES game by Mark Allen, author of SABOTAGE. Requires 48k Apple II/II+ with DOS 3.3. Available at your local computer store for $29.95 or order directly from Sierra On-Line Inc., 36575 Mudge Ranch Rd. Coarsegold, CA 93614.

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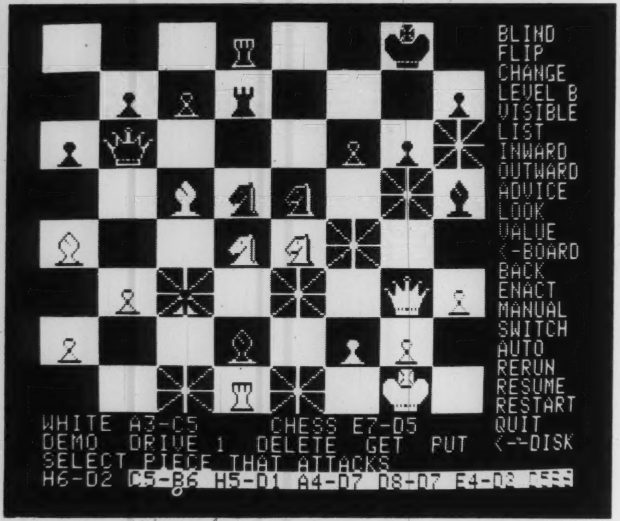

BLIND
FLIP
CHANGE
LEVEL 8
VISIBLE
LIST
INWARD
OUTWARD
ADVICE
LOOK
VALUE
<-BOARD
BACK
ENACT
MANUAL
SWITCH
AUTO
RERUN
RESUME
RESTART
QUIT
<--DISK

```
WHITE A3-C5       CHESS E7-D5
DEMO  DRIVE 1  DELETE  GET  PUT
SELECT PIECE THAT ATTACKS
H6-D2 C5-B6 H5-D1 A4-D7 D8-D7 E4-D3 [illegible]
```

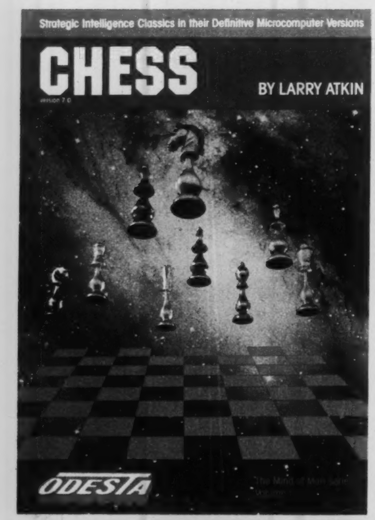
- ◀ Variations of blind-fold play—camouflaged or invisible pieces
- ◀ Invert board to play black on bottom
- ◀ Change pieces on board during game, or set up position
- ◀ Change between 15 levels of play, plus postal and mate-finder modes
- ◀ Show move that **Chess** is thinking about
- ◀ List played moves for each side
- ◀ Lines of force in: attacks and defenses on a square
- ◀ Lines of force out: squares attacked and defended
- ◀ **Chess** suggests a move
- ◀ Show moves **Chess** thinks you will make, and its responses
- ◀ Evaluation of a position
- ◀ Return to board or switch to command menu
- ◀ Take back a move (repeatable)
- ◀ Play move suggested by look-ahead search
- ◀ **Chess** plays neither side
- ◀ Switch sides
- ◀ **Chess** plays against itself—one level against another
- ◀ Replay through most advanced position
- ◀ Skip to most advanced position
- ◀ Start new game
- ◀ Leave program
- ◀ Save, get, and delete games to and from disk

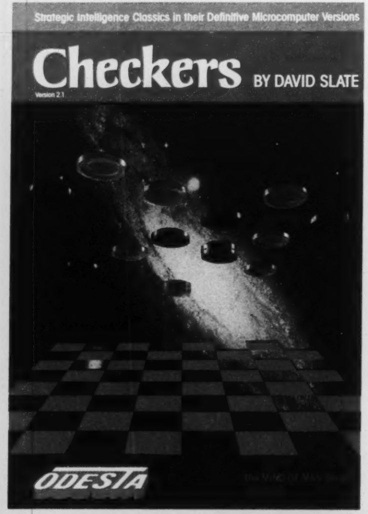
All features self-documented; all choices cursor-controlled
Screen shows "outward" and "look" features being used

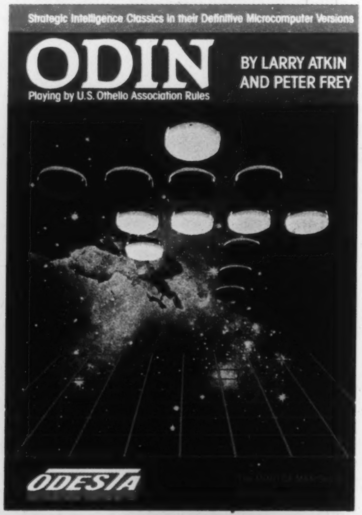
THE PEOPLE BEHIND THE PROGRAMS:

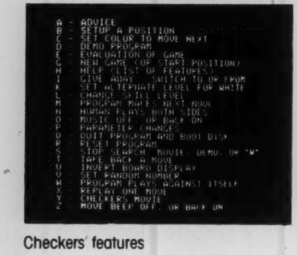
Larry Atkin & David Slate: Authors of the Northwestern University Chess 4.7 program—World Computer Chess Champion, 1977-1980

Peter Frey: Northwestern University professor
Editor: **Chess Skill in Man and Machine**
One of U.S. Othello Assoc.'s top-ranked players


Strategic Intelligence Classics in their Definitive Microcomputer Versions
CHESS
version 2.0
BY LARRY ATKIN
ODESTA

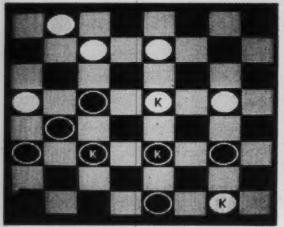

Strategic Intelligence Classics in their Definitive Microcomputer Versions
Checkers
Version 2.1
BY DAVID SLATE
ODESTA


Strategic Intelligence Classics in their Definitive Microcomputer Versions
ODIN
BY LARRY ATKIN AND PETER FREY
Playing by U.S. Othello Association Rules
ODESTA

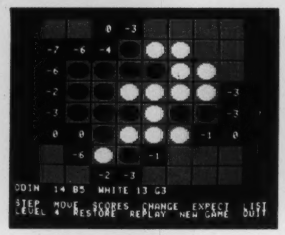


```
A - ADVICE
B - SETUP A POSITION
C - SET COLOR TO MOVE NEXT
D - DEMO PROGRAM
E - EVALUATION OF GAME
G - NEW GAME (OR START POSITION)
H - HELP (LIST OF FEATURES)
I - GIVE AWAY   SWITCH TO OR FROM
K - SET ALTERNATE LEVEL FOR WHITE
L - CHANGE SKILL LEVEL
M - PROGRAM MAKES NEXT MOVE
N - HUMAN PLAYS BOTH SIDES
O - MUSIC OFF, OR BACK ON
P - PARAMETER CHANGES
Q - QUIT PROGRAM AND BOOT DISK
R - RESET PROGRAM
S - STOP SEARCH, MOVIE, DEMO, OR "W"
T - TAKE BACK A MOVE
U - INVERT BOARD DISPLAY
V - SET RANDOM NUMBER
W - PROGRAM PLAYS AGAINST ITSELF
X - REPLAY ONE MOVE
Y - CHECKERS MOVIE
Z   MOVE BEEP OFF, OR BACK ON
```

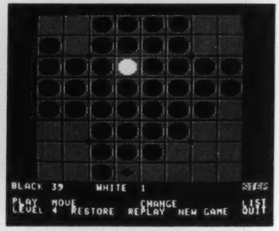
Checkers' features



Black to move and win
(From Checkers documentation)


ODIN 14 B5 WHITE 13 G3
STEP MOVE SCORES CHANGE EXPECT LIST
LEVEL 4 RESTORE REPLAY NEW GAME QUIT

"Scores" feature in Odin


BLACK 39 WHITE 1
PLAY MOVE CHANGE LIST
LEVEL 4 RESTORE REPLAY NEW GAME QUIT

A clue to the secret of Odin:
Black is destined to lose.

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(in Illinois, call 312-328-7101)

For **Apple II, Apple II Plus** 48K disk systems, and **Atari** 48K disk systems. Odin is also available for **TRS-80 Model 1 & 3** 32K disk systems.

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wipe the sweat from your brow. About the only thing missing is a high score feature. After playing *Borg* for four straight hours, I would have liked to have seen what my best score was.

A color TV or monitor is definitely necessary for playing *Borg*. The color of the obstacles helps a lot in determining which are electrified and which are not. It may take some time to get past the first room, and some may even give up in frustration. If you are looking for an easy game you can master right away, this is not the one. *Borg* is enough to challenge even the championship arcader's skill, but can be a lot of fun for beginners too. If you like Berzerk, you'll love *Borg*, because *Borg* has more—more color, more challenge, and more nail-biting excitement.—*RJR*

Computer Foosball

Foosball lovers unite! You now have an outlet for your frustrations in a new fast-paced simulation of the popular parlor game. *Computer Foosball* is an exciting rendition of this sport, which has playability remarkably similar to the real thing.

The game has one, two, and four player versions which involve a match between the Gruds and the Robots. In the single-player version, you control the Gruds (no offense intended) and your mighty Apple controls the Robots. The first one to score five goals is the winner, and is treated to a few bars of a rousing fight song.

The game begins by prompting for the number of players and the difficulty level. Normal and fast options control the maximum speed of the ball. The normal speed is by no means slow, and will require some practice before your Gruds can avoid embarrassment by the Robots.

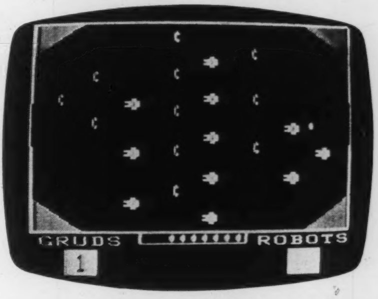
creative computing

SOFTWARE PROFILE

Name: Computer Foosball
Type: Arcade game
System: 48K Apple II, II+
Format: Disk
Language: Machine
Summary: Realistic foosball simulation
Price: $29.95 or free with purchase of Joyport
Manufacturer:
Sirius Software
10364 Rockingham Dr.
Sacramento, CA 95827.

The players are controlled by game paddles, which move them up and down. Pushing the button causes the players to kick the ball. The button is held down to avoid stopping the ball when it is already going the right direction (toward the goal).

Another feature that is notably similar to the actual game is the action in the corners of the field. The author, Keithen, simulated the banks of the foosball table, which serve to keep the ball in play. If the ball does come to a stop (as it does at times in the real game), hitting CTRL-B will re-serve it. These extra features make the game feel far superior to Pong-like versions I have played before.


GRUDS
ROBOTS
1

The two and four player versions can be even more invigorating. With two people playing, the second player controls the Robots. This may come as a relief; if your opponent is less skillful than the Apple, you may actually be able to win a game.

With this option there is the additional excitement of head-to-head competition, a feature seldom found in Apple games. So what could be better? Four players, of course! This option, available to owners of the Sirius Joyport, is the only one I have seen that enables four players to play simultaneously with all four pushbuttons operational.

Besides normal retail sales, the game is available free with the purchase of a Joyport. Either way, foosballers and non-foosballers will enjoy the action in this fast-paced game.—*DJ*

Horizon V

The microcomputer game industry is getting more sophisticated by the day. Game authors have begun to implement multiple scenarios, realistic three-dimensional graphics, and automatic increases in difficulty.

Horizon V is an excellent example of

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ARCADE PAK #7
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CONFLICT 2500
ACQUIRE
B-1 NUCLEAR BOMBER
Nukewar
GUNS OF FORT DEFIANCE
PLANET MINERS
LORDS OF KARMA

what a little imagination and some programming prowess can produce. A graphical masterpiece by Nasir Gebelli, it catches your eye immediately and beckons you to play.

The game starts by prompting for the mode of control—keyboard or joystick. It also has an option for modifying the keyboard. This is a feature I would like to see become standard in the future. Although there is no prompt for it (and there is no mention in the instructions), the game is compatible with the Sirius Joyport (hit control/shift/P).

In the first part of the game, you are hovering just above the surface of a gridded planet. Checking your radar display in the upper right of the screen (a la Battlezone), you spy the dots that represent the angry G-bellians, who think you've kidnapped Paulette the G-belly dancer.

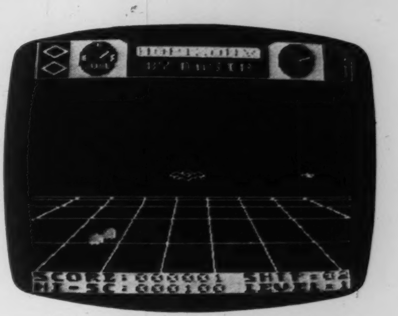
The G-bellians are obviously not familiar with our "innocent until proven guilty" concept, and proceed to attack. You have a limited amount of fuel, and must shoot as many adversaries as possible before trying to refuel.

The ship you are in always faces one direction, so maneuvering involves using the controls to move forward, backward, and laterally. This is made even more challenging due to a mysterious random wind of some type that tries to change your trajectory. It is the ability to counter this randomness quickly that separates the good players from those who are merely target practice for the G-bellians.

"Sure, it's impressive, but I like the computer enhanced photographs better!"

Before you know it, you find yourself low on fuel, and must abandon your dogfight to get more. This is accomplished by checking the fuel direction indicators which tell you where the time tunnel entrance is. If you can hover above it long enough, you will be whisked into the tunnel, where you must shoot more G-bellians.

However, here they are worth only 100 points each, whereas above the planet a shot could earn up to 600 points. This means strategy for high scores involves staying on the surface as long as possible, despite the risk of running out of fuel. This part of the game is sure to cause the player mental anguish and heart palpitations.



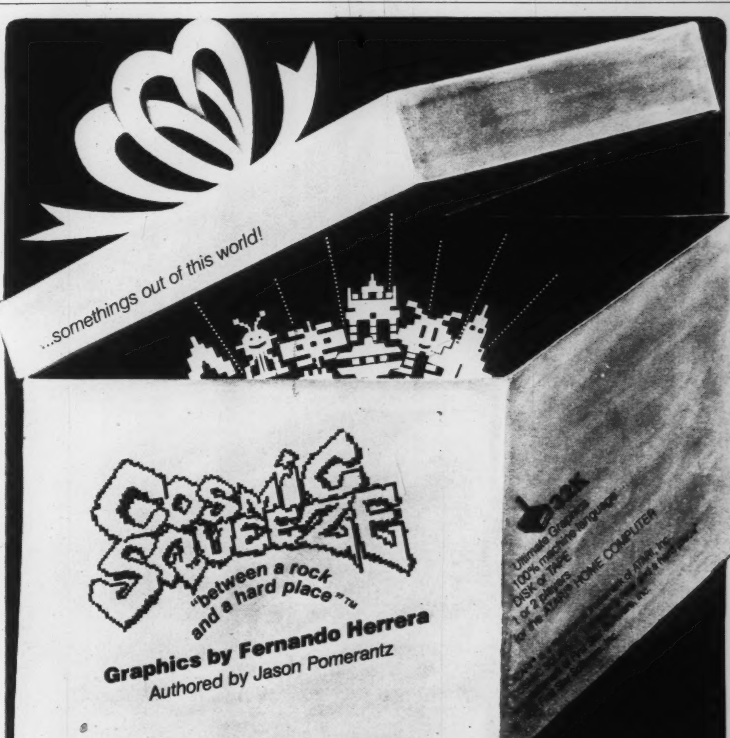
creative computing
SOFTWARE PROFILE

Name: Horizon V
Type: Arcade game
System: 48K Apple II, II+
Format: Disk
Language: Machine
Summary: Superb 3-D Shoot-em-up
Price: $34.95
Manufacturer:
Gebelli Software, Inc.
1787 Tribute Rd., Suite G
Sacramento, CA 95816

As if that were not enough, you still must shoot a number of these guys before you can proceed. Next stop is the fueling area, which appears as a series of growing concentric rings, a beautiful graphics effect.

By centering a crossmark in the middle (battling the mysterious wind all the while) you earn enough fuel to return to the surface. The planet has now changed colors, and the G-bellians are more aggressive.

The game continues in this cycle for as long as you can hold out. When the G-bellians have finally won out, high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Production: EUROSTYLE GRAPHICS (213) 393 5728

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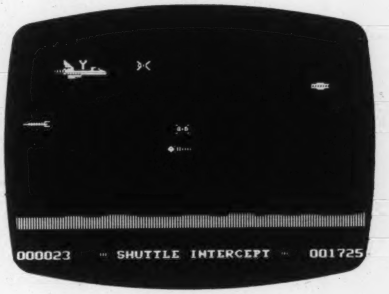
scorers' names are recorded with up to six letters, a nice touch that will keep you coming back for more—*DJ*

Shuttle Intercept

The object of *Shuttle Intercept* is to retrieve friendly satellites. At your disposal you have a high speed space shuttle, which always flies at the left side of the screen. Its vertical position is controlled by a paddle controller.



To start the game you press the paddle button once and the bay doors open. A second press raises your sky hook and fires your laser cannon. To retrieve a satellite, you must touch it with the upper part of your sky hook, which must be fully extended. Merely flying over it with your craft does you no good.

Unfortunately, in addition to friendly satellites, there are also enemy flying saucers, satellites, meteors, and missiles flying in the same air space. Each of these must be dealt with somewhat differently. Enemy craft and satellites can be destroyed with your laser cannon. If they are not destroyed, enemy satellites will destroy your shuttle while enemy craft will simply push down your sky hook and close the bay doors.

creative computing
SOFTWARE PROFILE

Name: Shuttle Intercept
Type: Arcade Game
Author: John Van Ryzin
System: 48K Apple, disk drive, paddle
Format: Disk
Summary: Retrieve Satellites
Price: $34.95
Manufacturer:
Hayden Software
50 Essex St.
Rochelle Park, NJ 07662

Meteors and missiles, on the other hand, must be avoided by skillful piloting of your craft. Meteors fly in a predictable course and are relatively easy to avoid, except if they are too close to a satellite you are trying to retrieve. On the other hand, missiles will track your shuttle and destroy it. I found the best strategy was to wait until they got close and then quickly move out of the way.

The game has four levels of play of increasing difficulty. In addition, at 5000 points, the speed of the missiles increases, and at 10,000 points the meteors begin to travel faster. Frankly, I was pleased with scores of two or three thousand. Any score over 1000 allows you to enter your name or initials as the higher scorer for a session, but scores are not saved on the disk.—*DHA*

Star Maze

Your mission is to find the nine power jewels in each level of the *Star Maze* and return them to your mother ship. Do this for all 16 levels and you become an Ace. That is an understatement! I had a tough time just retrieving five or six jewels on the first level.

In this game, you are flying a small space ship around the corridors of a maze. The maze is considerably larger than will fit on the screen, so you see only a small portion of it at one time. The program employs outstanding graphics which cause the maze to scroll by in a direction corresponding to your direction of movement.

You start out at the mother ship with a full fuel tank, three anti-matter bombs, and high hopes. A power jewel may be picked up by flying over it at a speed of 200 or less. This sometimes proves to be quite a challenge because, although it is relatively easy to locate the jewels, it is not always easy to slow the momentum of your ship sufficiently that you can

creative computing
SOFTWARE PROFILE

Name: Star Maze
Type: Arcade Game
Author: Gordon Eastman
System: 48K Apple, disk drive
Format: Disk
Summary: Space Jewels for the picking
Price: $34.95
Manufacturer:
Sir-Tech Software, Inc.
6 Main St.
Ogdensburg, NY 13669

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CIRCLE 173 ON READER SERVICE CARD

Actua

The size, of course, is a dead giveaway. But don't let the size fool you. The HX-20 is not a toy. Or a glorified calculator.

It's a computer.

A real computer, with 16K RAM (optionally expandable to 32K), and 32K ROM (optionally expandable to 64K), RS-232C and serial interfaces, a full-size ASCII keyboard, a built-in printer, a scrollable LCD screen, and sound generation. A micro-cassette and ROM cartridge are available as options.

Viva la différence!

In fact, the only differences between the Epson HX-20 and an ordinary computer are:

1) The HX-20 is small enough to fit inside your briefcase;
2) It'll run on its own internal power supply for 50-plus hours, and fully recharge in less than eight;
3) It gives you up to 10 program functions at the punch of a button;
4) It lets you interface with peripherals like the MX Series printers for correspondence quality output, the CX-20 Acoustic Coupler for remote communications, a barcode reader for inventory control, and an audio cassette for loading and saving programs;
5) It lets you shut the whole unit off while preserving all programs in RAM; and, last, but far from least,
6) It costs less than $800. That's right—less.

The perfect traveling companion

With the Epson HX-20 and the optional RAM expansion, you'll be able to compute just about anywhere. Because its nickel-cadmium batteries and a low-power, all-CMOS memory keep the HX-20 running for over 50 hours. And even if you shut the HX-20 off, a low-voltage system maintains all programs you have in RAM.

Little screen, big picture.

The HX-20's unique scrollable LCD screen is the ultimate answer to the question, "How do you get a big screen in a small space?" You just show part of it at a time.

EPSON
*** MENU ***
CTRL/I Initialize
1 MONITOR
2 BASIC
PRINTER
OFF ON
PAPER FEED
PAUSE
MENU
BREAK
PF1
PF2
PF3
PF4
TAB
CTRL
SHIFT

al size.

Optional Microcassette

HX-20
D CRYSTAL DISPLAY 120 X 32 DOTS: 20 CHARACTERS BY 4 LINES
ENU ***
I Initialize
ITOR
IC
MC-30
MICRO CASSETTE DRIVE
REC
PF5
NUM
HOME CLR
SCRN
INS DEL
RETURN
SHIFT
GRPH

So with the HX-20, you can do programming, word processing and data entry just like you've got a big screen, up to 255 characters wide, with easy-to-read upper and lower case letters, numbers and punctuation and any 20 column by four line part of it visible by user command.

Built in hardcopies.
The HX-20's built-in 24 column dot matrix impact microprinter hands hardcopies to you at 42 LPM, in a crisp, precise 5x7 matrix. It even has bit addressable graphics to give you a pint-sized sales chart, and enough international symbols to print most Western languages.

Epson makes more and better printers than anyone else in the world. Need we say more?

The best is yet to come.
When you hold an HX-20 in your hand, you're not only holding a lot of capacity, you're holding a lot of expansion.

There's a standard cassette interface, a cartridge interface, the RS-232C and serial interfaces, and a system bus that lets you expand RAM and ROM capabilities. There's even a floppy disc drive for maxi capacity in a mini package.

The Epson edge.
Surprised that a computer like the HX-20 should come from Epson? You shouldn't be. Because we've been building computers in Japan since 1978. And we've been practicing ultra-high-quality precision manufacturing for a lot longer than that.

We didn't jump right into the American microcomputer market. We could afford to bide our time; to wait for the product that was going to stand America on its ear.

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The Epson HX-20.

EPSON

EPSON AMERICA, INC.

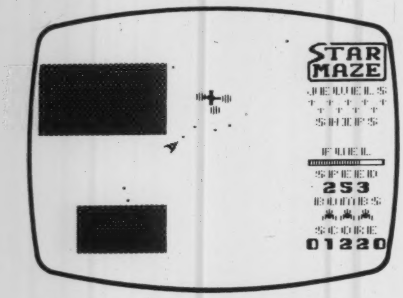
COMPUTER PRODUCTS DIVISION

3415 Kashiwa Street
Torrance, California 90505
(213) 539-9140

CIRCLE 168 ON READER SERVICE CARD

pass over them at such a slow speed.

Furthermore, to drop the jewel off at the mother ship you must also be travelling slower than 200. In fact, if you fly over your mother ship with a speed of 100 or less, you will also refuel. The need to refuel is indicated by both a fuel gauge and an audible warning.



You have three star fighters with which to complete your mission. Flying around the maze, you will find alien cruisers, scout ships, saucers, UFOs, meteors and even a strange little train of outer space bugs. You can destroy an enemy either by shooting bullets at him (bullets in an outer space game?) or by firing an anti-matter bomb.

In a tight situation, you may also elect to enter hyperspace which transports you to another part of the maze. This is not always a good idea since hyperwarp uses a great deal of fuel and you may wind up in the middle of a screen full of enemy ships.

The game may be played from a keyboard, with a standard joystick, or with a switch-type joystick with the Sirius Joyport. Frankly, I found none of them entirely satisfactory. In keyboard mode, ten keys are in use, although only six are used regularly. That's too many for my uncoordinated fingers. Regular joystick mode is somewhat easier, although you still need the keyboard to detonate anti-matter bombs or enter hyperspace. But perhaps I am just being petulant because I was never able even to come close to mastering the game.

However, at the risk of adding yet another control, I feel that a speed break would increase the playability of the game. On the other hand, the momentum of the ships is very realistic and perhaps is what one ought to expect in outer space.—*DHA*

Seafox

As a submarine captain of the Seafox, you must destroy all of the merchant ships (the top row of ships on the screen) in order to move on to the next mission. Hampering you are other submarines which try to ram you or shoot torpedoes at you. Also, hospital ships frequently come between you and the merchant ships.

If one of your torpedoes hits a hospital ship, it bounces off it harmlessly and heads for the ocean floor. Unfortunately, during this time you are unable to fire anything and are at the mercy of the enemy submarines, and only skillful maneuvering can insure your survival.

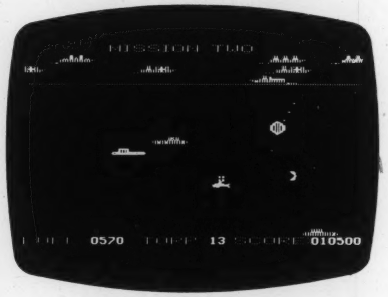
creative computing
SOFTWARE PROFILE

Name: Seafox
Type: Arcade Game
Author: Ed Hobbs
System: 48K Apple, disk drive, joystick recommended
Format: Disk
Summary: Challenging underwater battle
Price: $29.95
Manufacturer:
Broderbund Software, Inc.
1938 4th St.
San Rafael, CA 94901

Skillful maneuvering is increasingly necessary on advanced missions as you dodge exploding depth charges, torpedo fire, and magnetic mines.

Your sub has a limited supply of fuel and torpedoes which mut be replenished frequently. Occasionally, a supply sub passes by near the ocean bottom and releases a trained dolphin carring fuel and torpedoes. You must make contact with the dolphin's supply pack in order to resupply your vessel. If your sub harms the dolphin, watch out! He has many friends in these waters and they don't take too kindly to it. Giant clams may also interfere with refueling so it is best to collect your supplies quickly.

Your submarine may be controlled by either the keyboard or a joystick. Paddle control is also theoretically possible, but nearly impossible for normal humans. I also found keyboard control very difficult since 11 keys are used to control directions, and firing. A self-centering joystick is by far the most satisfactory. However, both firing buttons must be operational since button O fires torpedoes up and button 1 fires them forward. Although you may move your sub in any direction, forward is always to the right side of the screen. Thus, the only way to get a submarine approaching from the left is by using your upward torpedo when you are under it.



On the lower levels, I found *Seafox* considerably easier to play and much less frustrating than several of the other submarine games on the market. Although the hazards increase on the upper levels, I generally had a nice sense of accomplishment as I progressed through the game. My applause goes to Ed Hobbs for creating a game which can be enjoyed by clods and experts alike.–*DHA*

Mars Cars

On the package we read: "On the War God's planet, his vicious Mars Cars have been programmed to sense, search out, and destroy any alien adventurer, who dares seek his timeless treasures. And on Mars, you are the Alien!

"Enter this inter-planetary battle of wits and agility. Travel 16 danger filled levels, defeat the killer Mars Cars and return to earth with a King's ransom."

At your disposal you have a tough little excursion vehicle. The planet is far different than you were ever led to believe by the Viking Probes or telescope observation. There are no canals, no deserts, no ravines. Instead you find a series of lightweight barriers. These may be easily destroyed by simply ramming

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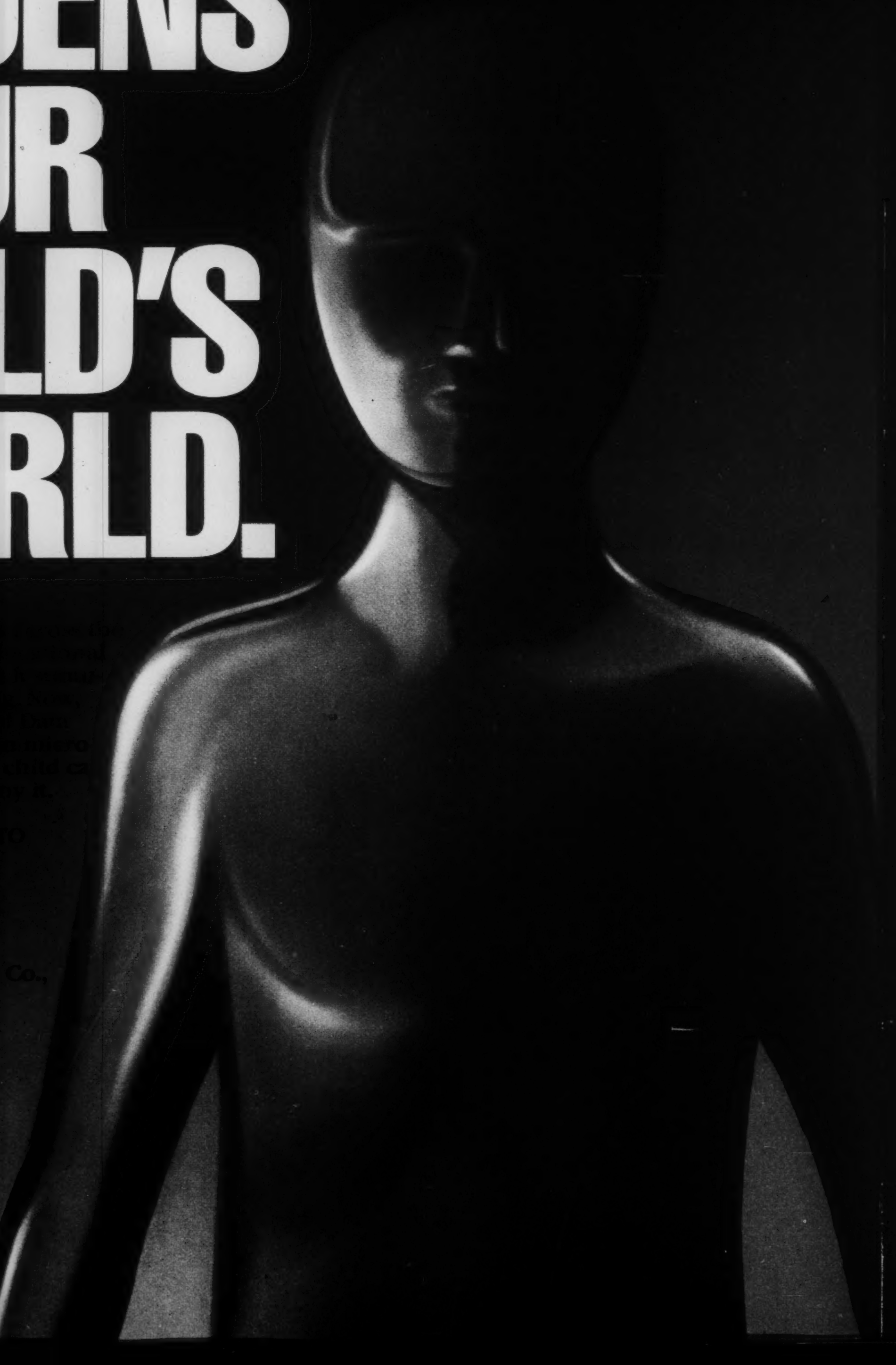

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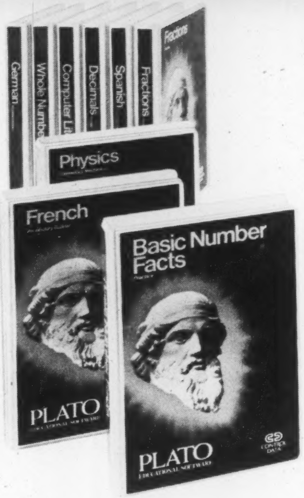
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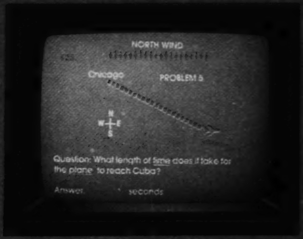


Question: What length of time does it take for the plane to reach Cuba?

Answer: seconds

CONTROL DATA

PLATO

COMPUTER-BASED EDUCATION

CIRCLE 149 ON READER SERVICE CARD

them, but the entire surface is not covered with barriers.

The barriers form garages (or pens) around treasures and deadly Mars Cars. Your challenge is to head out into this land of barriers and Mars Cars, retrieve the four treasures in the corners of each of the 16 boards, and head for the exit (which is actually the entrance to the next level).

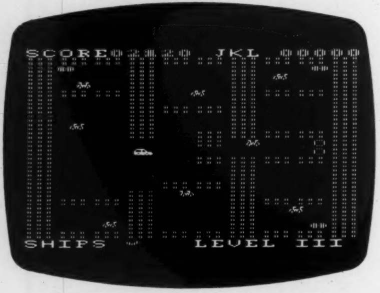
On the lower levels, the Mars Cars simply bounce around within their pens and follow predictable patterns around which you can generally manuever. However, on the higher levels, the cars become more intelligent and seem to pick up your scent as they close in for the kill.

creative computing
SOFTWARE PROFILE

Name: Mars Cars
Type: Arcade Game
Author: David Husch
System: 48K Apple, disk drive joystick recommended
Format: Disk
Summary: Martian demolition derby
Price: $29.95
Manufacturer:
Datamost, Inc.
9748 Cozycroft Ave.
Chatsworth, CA 91311

You score 10 points for each barrier you destroy and 100 points for each treasure. While it is quite easy to destroy many barriers for big scores, this has the peril of releasing more Mars Cars than you may be prepared to deal with.

Once you have all four treasures on a level, you must head for the exit gate at the center of the right side of the screen to reach the next level. There you will find more treasure, more barriers, and more "devious" Mars Cars.



Although I tried every trick in the book in this Martian demolition derby, the highest I ever got was the 11th level. But wait until tomorrow; I'll make it to level 16 yet.—*DHA*

Marauder

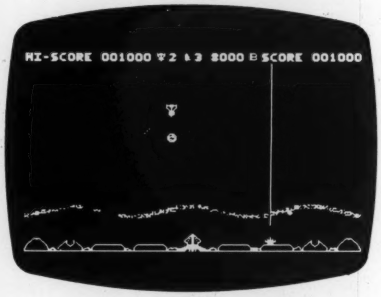
In Level I of *Marauder* (the first game), you are the pilot of a ship attacking an alien planet and its defense installations. The first line of defense is an energy shield which covers the surface of the planet. You can maneuver your small craft around the screen using a joystick (or keyboard if your fingers are more coordinated than mine).

Your weapon always points down and is fired with Button 1. Button O gives an added burst of speed to avoid enemy fire. This should be used sparingly since there is a four-second interval between permissible uses of that function. You must destroy seven defense installations (nine at higher levels of play) before you fly into the ruins of the fireball launcher and enter the labyrinth of the city.

creative computing
SOFTWARE PROFILE

Name: Marauder
Type: Arcade Game
Authors: Rorke Weingandt and Eric Hammond
System: 48K Apple, disk drive, joystick
Format: Disk
Summary: Invade the alien homeland; two games
Price: $34.95
Manufacturer:
Sierra On-Line
36575 Mudge Ranch Rd.
Coursegold, CA 93614

Needless to say, these defense installations are not just sitting still waiting for



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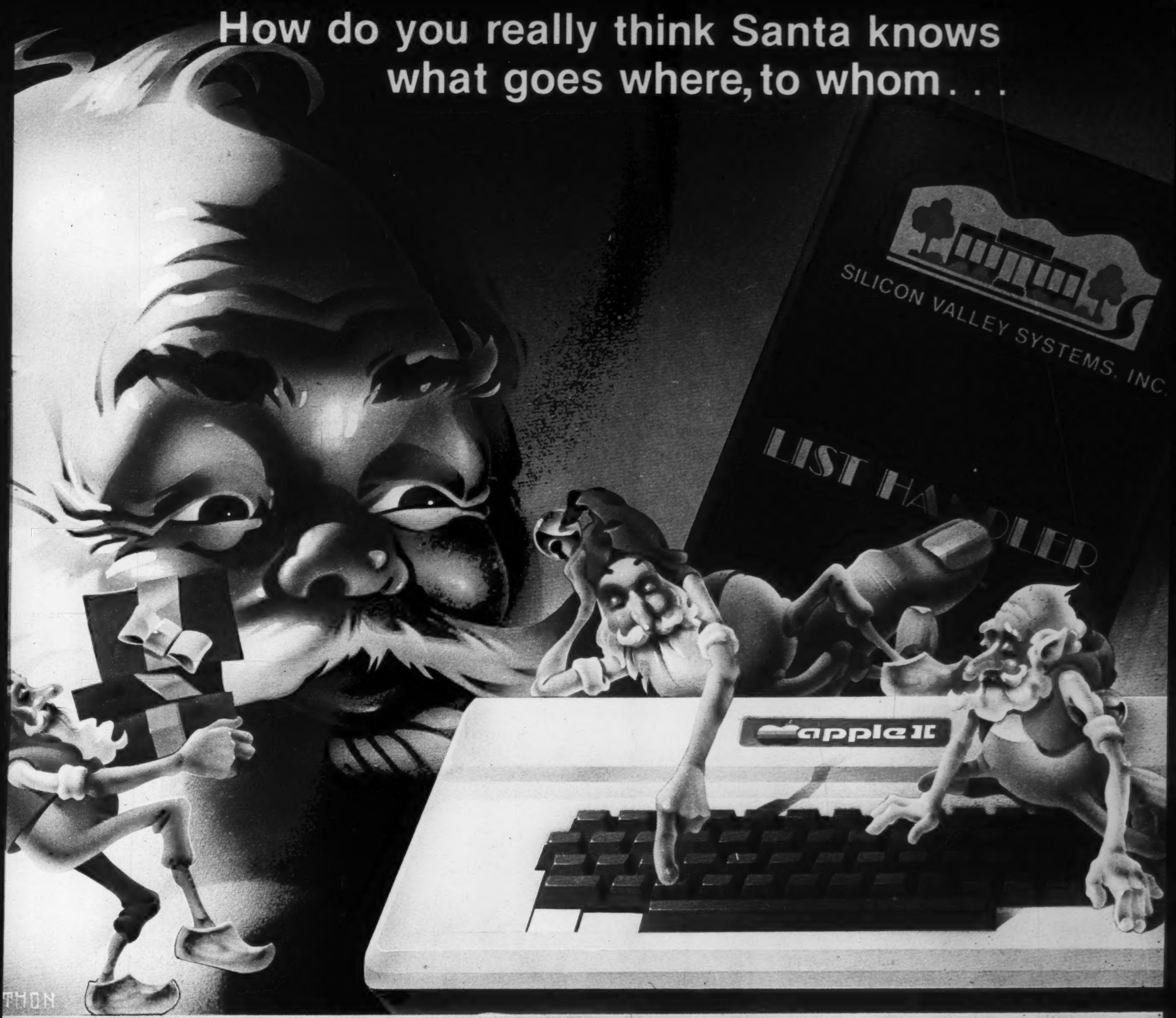
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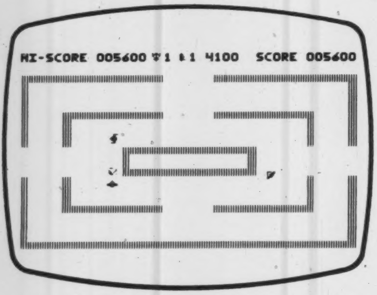
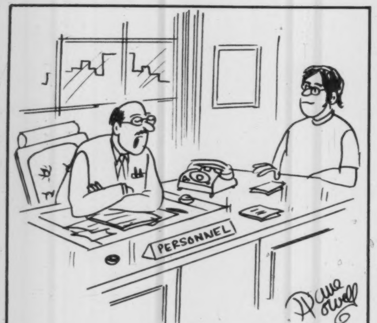
you to knock them out. There are guided missile bases, mine launchers, lasers, and fireball launchers, all of which are bent on your destruction. Missiles and mines can be destroyed, but the fireball cannot, so it is the one of which you must be most wary.

Level II (the second game) begins when you enter the city and start searching for the power station which supplies life support for the defending aliens. Naturally, the power station is guarded by nasty robot guards which communicate with one another as well as see and hear your shots as you wander around the Berzerk-style maze. You, on the other hand, can see only those robots that are within your field of vision.



Your marauder can be killed by either shots from a robot or falling bricks from the ceiling. If you survive the robots and get a direct hit on the power center with your hand weapon, you get whatever bonus points are still on the timer when you destroy it.

However, destroying the power center starts a chain reaction which eventually destroys the entire alien world. After hitting it, you have 2000 units of time to return to your ship before the ceiling begins to fall. A safe return leaves you ready for your next planetary assault. There are 16 levels of play on the disk, more than enough to challenge even the best arcader.—*DHA*



"Just leave your name...we'll call you when the need arises for a video-games champion..."

Mission Impossible

If you have been with computers for even a little while, you have probably heard someone talking about adventures. The adventure game began years ago on the big systems and found its way to the micro thanks to the efforts of Scott Adams.

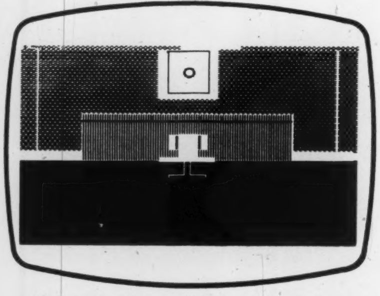
creative computing

SOFTWARE PROFILE

Name: Mission Impossible
Type: Hi-res Adventure
System: 48K Apple, disk drive
Format: Disk
Language: Machine
Price: $29.95
Manufacturer:
Adventure International Inc.
P.O. Box 3435
Longwood, FL 32750

Scott took the original game and scaled it down somewhat to produce his first program, *Adventureland*. Since then, Scott has formed his own company (Adventure International), and adventuring has become a popular pastime among computer people everywhere.

Scott has recently re-written his 13 adventure programs to include graphics and speech. Using a special picture packing technique, he has managed to cram over 100 high-resolution color pictures onto a single adventure disk. The result is the Scott Adams' Graphic Adventure (S.A.G.A.) series.

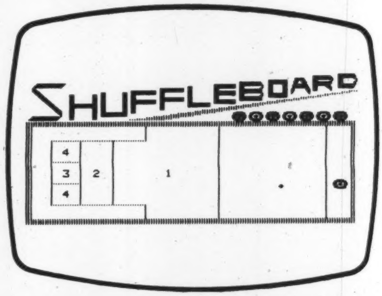


Although the graphics are spectacular, the real fun is listening to the speech. If you have a Votrax Type-N-Talk unit, you can specify speech output at the beginning of the game and enjoy audible prompts throughout the game. Don't worry if you don't own a Votrax, however. The program will run fine without it. A complete menu allows you to customize the game to suit your mood. If you don't want the pictures, or you feel like playing without the speech, you just select the appropriate option from the main menu.

Mission Impossible is an adventure set inside a nuclear reactor. It has been rigged to explode and you must deactivate the bomb before detonation. Armed with only a bomb detector and a tape recorder, you race against the clock to save the reactor.

It is hard to imagine a micro owner who doesn't have at least one adventure game in his files. If you already own a non-graphic *Mission Impossible*, don't throw it away. The old version is exactly the same as the S.A.G.A. series and is an excellent way to enter the world of adventuring.—*CV*

Shuffleboard



Innovative Design Software is known for their non-violent games. Games such as *Juggler* and *Pool 1.5* have done extremely well and have earned the praise of gamers everywhere. Their latest release, *Shuffleboard,* is sure to equal its predecessors in popularity and playability.

On the top half of the screen, the playing surface is displayed. If you are not familiar with the layout of a standard shuffleboard, don't worry, the instruction manual is very thorough in describing the rules and the scoring. Two game options, "Tally All" and "Cutthroat" are available.

creative computing

SOFTWARE PROFILE

Name: Shuffleboard
Type: Simulation
System: 48K Apple, disk drive
Format: Disk
Language: Machine
Price: $29.95
Manufacturer:
IDSI Inc.
P.O. Box 1658
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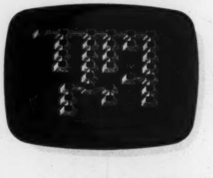

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Aiming the puck is accomplished with the U and D keys. All you have to do is line up the puck and the aimer. After you select the force with which you will push the puck, the S key sends it sliding down the floor.

If you can't find anyone around who wants to play a game, *Shuffleboard* has a computer play mode which is always ready to go. While playing against the Apple, we were surprised at the fairness of the program. Sometimes, computer routines cheat by making moves too accurate for humans to reproduce. Not so with *Shuffleboard*. The computer is challenging player, but not impossible to beat.

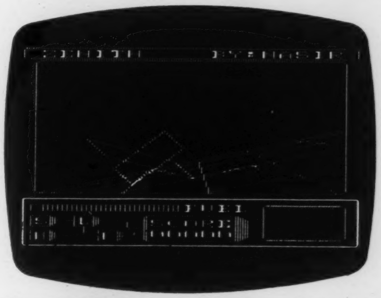
Shuffleboard is a pleasant computer adaption of a classic game. Whether you are a shuffleboard fan or not, this package is worthy addition to any software library.—*CV*

Zenith

Zenith is a 3-D action game in which you must defend a helpless space colony from alien attack. These aliens just don't want any humans to occupy their galaxy. In fact, they are ready to destroy anything that you may try to build. To rid yourself of these troublemaking creatures, you must blast their ships with your lasers and then capture the alien pilots with your rescue claw.

So far it sounds pretty much like any other game. However, why would anyone want to capture the aliens? Why not let them die out in space? Well, it turns out that the aliens are necessary for your survival. During play, fuel, shield, and laser energy are consumed by your ship. The only way that you can replenish your supplies is by purchasing them from the aliens' base ship. The currency is, of course, your alien hostages.

After you gather four aliens in your collection chamber, your ship is automatically drawn to their base and your cargo is exchanged for fuel. It sounds easy, but catching the alien astronauts is extremely difficult.



In addition to the task of retrieving the spacemen, there is a time limit involved in play. If you do not bring your hostages back to their base soon enough, they begin to suffocate, and will die in minutes.

The entire battle takes place over an animated 3-D grid. As you are turning, diving, and climbing, the ground pattern changes to give you the feel of flight. Even our best programmers were amazed at the animation techniques employed in *Zenith*.

In summary, *Zenith* is a well executed game that is sure to amuse everyone. The graphics are excellent, and the idea is new. *Zenith* gets our highest rating.—*CV* ☐

creative computing
SOFTWARE PROFILE

Name: Zenith
Type: Arcade
Author: Nasir Gebelli
System: 48K Apple, disk drive, joystick optional
Format: Disk
Language: Machine
Summary: Excellent 3-D graphics
Price: $34.95
Manufacturer:
Gebelli Software Inc.
1771 Tribute Rd., Suite A
Sacramento, CA 95816

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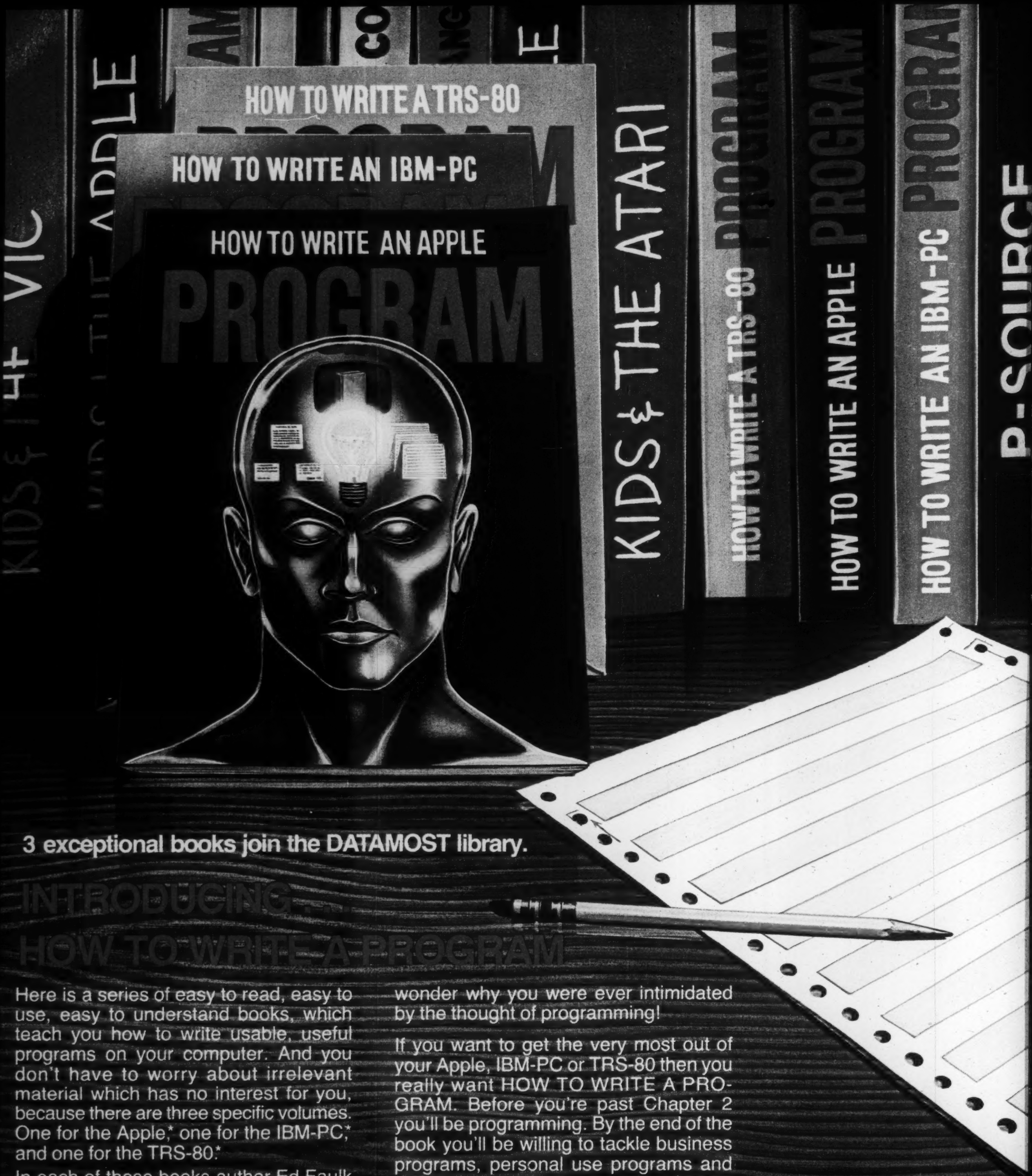
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An Adventure Game for the Apple II With (Almost) Everything

Robert Plamondon

What would you expect from the ideal adventure game? A good plot, of course. A game that gives you many options would be nice — too many games practically play themselves. Excitement (maybe combat) is important, too. Perhaps a series of adventures would be more fun than just one. And, of course, the game should be without obvious flaws.

Many games meet these criteria, but very few are available for less than $5 per adventure. And only one is designed to allow you to write your own adventures without actually doing any programming. This game is called *The Wonderful World of Eamon.*

Description

Eamon is an all text adventure game, revolving around the activities of a make believe character in a make believe setting.The Computer describes the setting, and the player controls his character with two-word commands, such as GET TREASURE, or FREE PRINCESS. The adventure is usually a quest: the character must recover something, such as a kidnapped princess or a cure for the Black Plague.

Unlike most adventure games, the difficulty in succeeding in the quest is caused by unfriendly creatures, not by a series of riddles. The problem lies in reaching the goal before being hacked to pieces, not in trying to puzzle out a series of ambiguous clues. This makes *Eamon* more exciting than many adventure games.

Illustrations by Gerald Doherty, 454 New Bedford Rd., Luton, Bedfordshire, England.

Robert Plamondon, 667 SW 15th Street, Corvallis, OR 97333.

Eamon has a Master Diskette which contains the programs for creating characters, buying goods, and so on. It also contains a short adventure, called The Beginners' Cave. To the best of my knowledge, *Eamon* is available only for the Apple II, but it could be adapted to other computers, since it is written entirely in Basic.

Playing Eamon

When you boot up the Master Disk, you are asked for your character's name. The program searches through the list of your old characters. If it finds an old character with the same name, it reads in that character's statistics and sends you to the next program; the Main Hall.

If it doesn't find a character, it assumes you want to create a new one and rolls up some statistics. Characters have three major attributes: hardiness, agility, and charisma.

Hardiness is a measure of the character's strength and his ability to take punishment. Agility is related to his ability to hit what he is aiming at. Charisma is the ability to deal amicably with other creatures.

The Main Hall program allows you to purchase weapons, armor, and spells, and to sell the loot obtained on adventures. New characters start with a small amount of money — enough to buy second-rate armor, a weapon, and maybe a weak spell. After browsing through the Main Hall, the character is ready for an adventure.

Adventures

There are 25 *Eamon* adventures available now, and several more in various stages of completion. The adventures vary enormously in style, the wide variety being one of the best features of the game.

Unfortunately, they vary in quality, as well — but the best adventures are *very* good, and all of them are *very* cheap, so you don't waste much money if you happen to choose a poor one.

When you are ready to go on an adventure, the Main Hall program will tell you to put the adventure disk in the drive and hit the C key to begin your adventure.

The adventure usually starts with a description of what is going on. A typical situation is that some villain has done something unspeakable, and has kidnapped a princess as well. Your job is to kill the villain, undo the evil deed, and rescue the princess. (This scenario is amazingly durable; it appears not only in the usual fantasy settings, but in adventures such as The Death Star, as well.)

After informing you of your plight, the disk spends a minute or so reading in the Base Dungeon Program and data for the adventure. After the computer has digested a few thousand bytes of data, the adventure begins.

Most features of *Eamon* will be familiar to adventure gamers: There are unknown areas to explore, treasures to be found, and problems to solve. Most *Eamon* adventures lack a save game feature, which makes it impossible to quit in the middle without consigning your character to oblivion. On the other hand, it avoids one problem of the other games, in which you can save the game as insurance — by saving the game every five minutes, you can undo a character's death by loading in the saved game.

> ***A typical situation is that some villain has done something unspeakable, and has kidnapped a princess as well.***

This tends to make the adventure a test of game-saving strategy, rather than a test of skill in the game itself. In *Eamon*, when a character dies, he stays dead. This makes adventuring a lot riskier, but risk makes the game more exciting.

Critters and Combat

While most of *Eamon* is similar to traditional adventure games, it has two unusual features: the ability to make friends during the adventure, and a complete combat system.

Creatures in *Eamon* come in all shapes and sizes. Some are friendly, some are hostile, and some can be either, depending on the character's charisma and luck.

Interaction with other creatures is rudimentary: if a critter likes you, it follows you around and helps fight your enemies. If it dislikes you, it attacks you. If it is neutral, it ignores you, and refuses to attack either your friends or your enemies.

Gifts can influence a creature's reaction to a character. Giving out gold can sometimes make a hostile creature friendly. Giving a friendly creature junk to carry may make it hostile. A character of mine once gave a destroyed 'droid to the Wookie in the Death Star adventure. The Wookie displayed his resentment at being used as a pack animal by killing my character.

Combat is a major ingredient of these adventures. *Eamon* was designed with fantasy role-playing games in mind, and has an excellent combat system.

When one creature tries to hit another, its ability to hit is equal to its weapon skill minus the dodging skill of the target. The amount of damage done by a blow is determined by the weapon type. Armor absorbs a certain amount of damage per blow; the remainder is subtracted from the defender's hardiness. If the creature's hardiness drops to zero, it dies.

This applies to characters, too; characters die quite often in *Eamon*. Fortunately, these deaths aren't random or arbitrary (as they are in some of the poorer commercial games). Combat is dangerous, and if you fight, your life is in danger. If you pick your fights carefully, you lose fewer characters.

Every time your character uses a weapon or spell successfully, there is a chance that his ability in that skill will increase. This lets your characters learn from experience, and as their skill increases, they can tackle progressively more difficult adventures.

Figure 1 shows part of a game, including combat.

Designing Adventures

One of the special *Eamon* diskettes is the Dungeon Designer Diskette, or DDD, which has a collection of programs to help you create your own adventures.

Eamon is structured so that information about the adventure, such as monster descriptions, room layout, and artifact data, are all stored in disk files. The Base Program uses these data to run the adventure.

This means that all you have to do is write the data files; the adventure progam is already written. The upshot is that *Eamon* adventures can be written without doing any programming at all.

The programs on the DDD prompt the user for input, and have several useful text editing commands, making it easy to input the data for an adventure. The procedure for typing in an adventure is really quite simple; the hard part is coming up with good ideas for adventures.

Recommended Programs

Eamon was developed by Donald Brown for the purpose of putting a computer role-playing games system in the public domain. While most designers are content to design each adventure from scratch, Brown designed an adventure *system*, with programs to help authors create their own adventures.

Since *Eamon* is in the public domain, it is legal, ethical, and fun to make cop-

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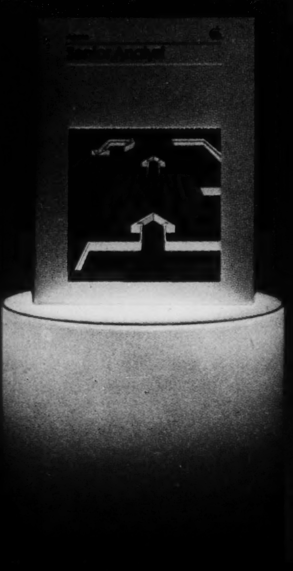
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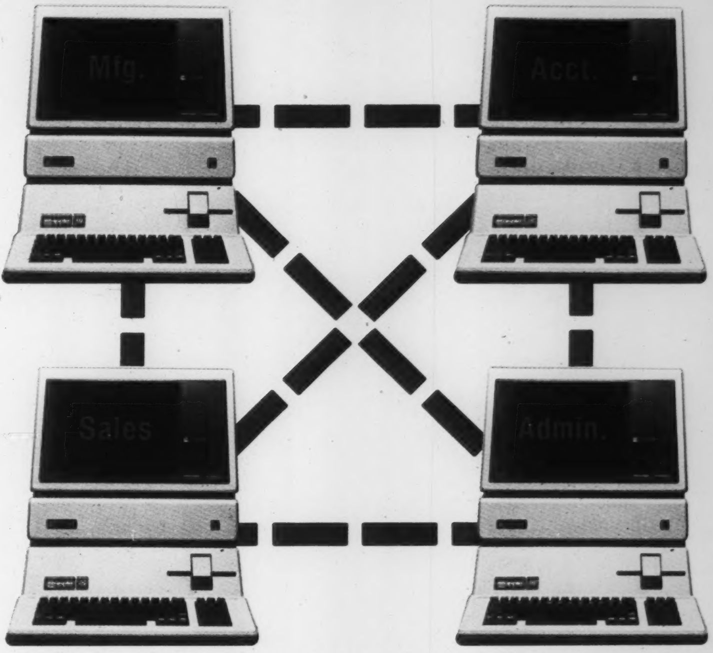

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ies of the programs for your friends. Finding them is something of a trick, however. While I know of 25 adventures, there may well be hundreds of which I have not heard, because the authors haven't made their creations known.

A complete list of adventures known to me is in Figure 2. The adventures I recommend for beginners are:

Eamon Master Diskette by Donald Brown. You *must* have this diskette to go on adventures. The Master Diskette includes The Beginners' Cave (a simple adventure), a couple of utility programs, and the special Master Diskette programs.

The Temple of Ngurct by James and Robert Plamondon. This is a very sophisticated adventure, if I do say so myself. My brother wrote the adventure itself, and I tinkered with the programs. Your character is sent on a quest to steal the medallion of the demon Ngurct.

Death Star by Donald Brown. This is by far the funniest adventure. Your character must shut off the tractor beam in the Death Star so he can escape in the Millenium Falcon. The Storm Troopers are even worse shots than they were in the movie. Donald Brown told me that this adventure was supposed to be a serious science fiction adventure, but failed. I think it is a great success as a slapstick fantasy adventure.

The Caves of Mondamen by John Nelson. Second only to Ngurct in sophistication, this adventure pits you against the evil Mondamen, who has an army, a magician, the demon Vaprak, a captive princess, and an underground stronghold. You have your wits and two friends, a big guy named Fred, and a short guy named Barney. This one is difficult, but fun.

Finding Eamon disks

Donald Brown told me that a group called Magnetic Fantasies is the official *Eamon* distributor. Whether this actually means anything is unclear. I have been unable to find Magnetic Fantasies' address, and I know nothing about them, beyond the fact that Donald Brown recommends them.

One source I *do* know something about is the Apple Avocation Alliance, Inc. (AAA). The AAA has 20 of the 25 "known" adventures, and will probably have them all by the time you read this.

The AAA's main function is to distribute public domain software for the Apple at low cost. There are several ways of getting programs from AAA:

1. Send a disk with ten Apple programs that aren't in AAA's catalog, and receive a disk of AAA programs in exchange. AAA even pays return postage.

2. If you don't have programs to exchange, you can always pay cash. The fee for copying AAA disks onto your disks is $1.00 per disk side (a common practice is to put programs on both sides of the disk).

3. If you don't want to send disks, you can buy them with the programs. AAA charges $3.50 for Verbatim Datalife disks, for $3 Memorex disks, and $2 for used disks.

There is also a fee of $27 on your first order or exchange.

Send orders and inquiries to Ron Maleika, Apple Avocation Alliance, Inc., 721 Pike St., Cheyenne WY 82001.

A third source of *Eamon* adventures is John Nelson at 1226 E. University, Des Moines, IA 50316. John has written several excellent *Eamon* adventures, and always seems to have a few more in the works. He is also trying to coordinate the *Eamon* adventures by making sure new adventures don't have the same names and volume numbers. People who are considering writing an *Eamon* adventure should drop him a line.

There are some differences between John Nelson's inventory and AAA's, mostly because AAA doesn't have all of John's adventures at this writing.

Eamon adventures can be obtained from John Nelson for $5 each.

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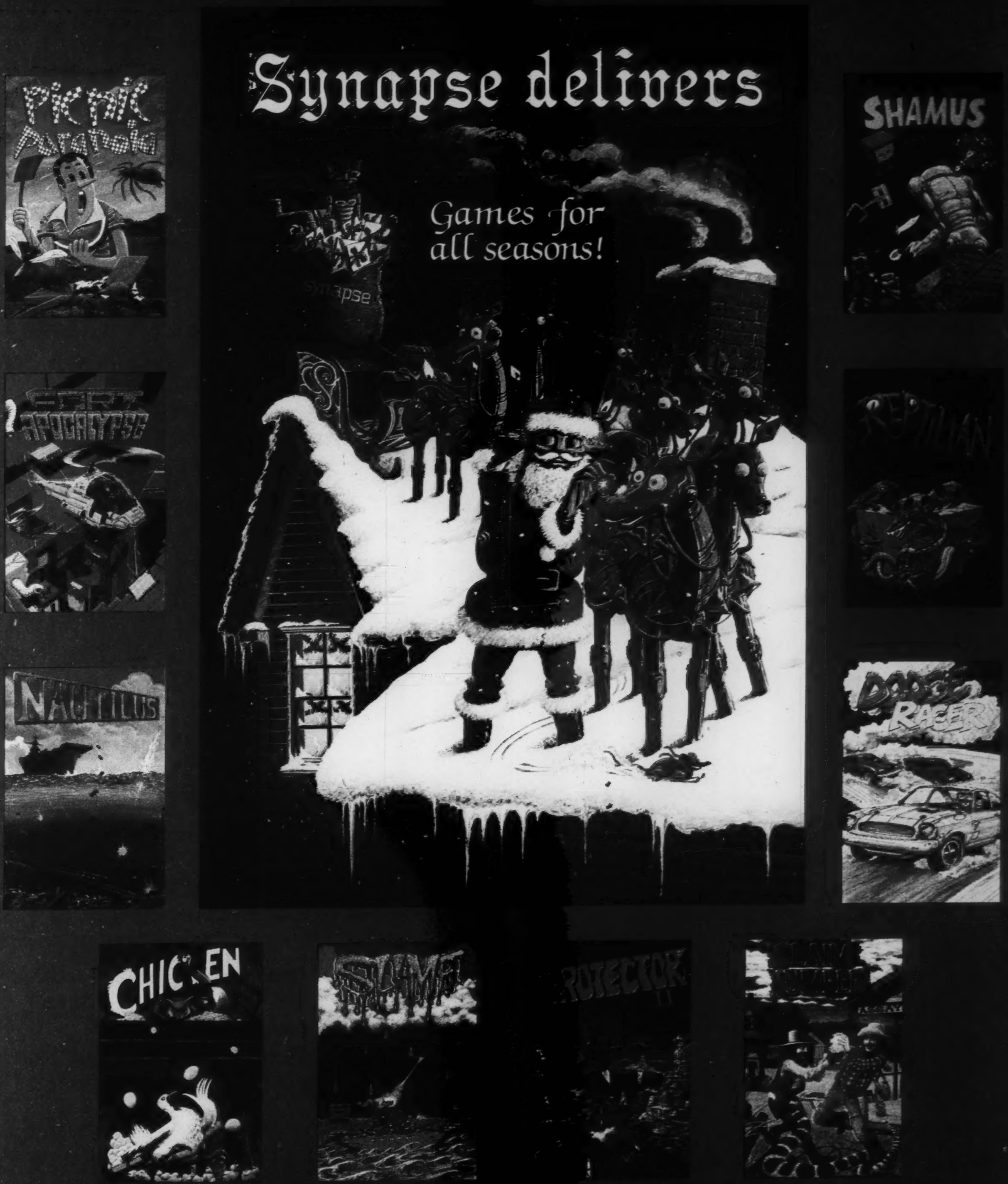
Figure 1: Part of an Eamon *adventure. A character named Marcus Antonius buys a spell in the main hall, and goes adventuring in The Beginner's Cave. After meeting a friendly warrior named Heinrich, Marcus Antonius encounters a wolf and a cave man.*

```
AS YOU WANDER ABOUT THE HALL, YOU
REALIZE YOU CAN DO ONE OF SIX THINGS--
  1.  GO ON AN ADVENTURE.
  2.  VISIT THE WEAPON SHOP FOR WEAPONS
      AND/OR ARMOUR.
  3.  HIRE A WIZARD TO TEACH YOU SOME
      SPELLS.
  4.  FIND THE BANKER TO DEPOSIT OR
      WITHDRAW SOME GOLD.
  5.  EXAMINE YOUR ABILITIES.
  6.  TEMPORARILY LEAVE THE UNIVERSE.

 (HIT THE KEY FOR YOUR CHOICE, 1-6)5

YOU ARE THE MIGHTY MARCUS ANTONIUS

YOUR ATTRIBUTES ARE:
  HD=14  AG=21  CH=22

YOU KNOW THE FOLLOWING SPELLS--
   NO SPELLS

YOUR WEAPON ABILITIES ARE--
  AXE   BOW   CLUB  SPEAR SWORD
    5%  -10%   20%   10%    0%

ARMOUR: LEATHER AND SHIELD   AE=0%

GOLD IN HAND=87, BANK=0

WEAPONS             CMPLX   DAM
SWORD                 10%   1 D 8
(HIT ANY KEY TO CONTINUE)

AS YOU WANDER ABOUT THE HALL, YOU
REALIZE YOU CAN DO ONE OF SIX THINGS--
  1.  GO ON AN ADVENTURE.
  2.  VISIT THE WEAPON SHOP FOR WEAPONS
      AND/OR ARMOUR.
  3.  HIRE A WIZARD TO TEACH YOU SOME
      SPELLS.
  4.  FIND THE BANKER TO DEPOSIT OR
      WITHDRAW SOME GOLD.
  5.  EXAMINE YOUR ABILITIES.
  6.  TEMPORARILY LEAVE THE UNIVERSE.

(HIT THE KEY FOR YOUR CHOICE, 1-6)3

AFTER A FEW MINUTES DILIGENT SEARCHING,
YOU FIND HOKAS TOKAS, THE OLD MAGE. HE
LOOKS AT YOU AND SAYS, 'SO YOU WANT OLD
TOKEY TO TEACH YOU SOME MAGIC, HEH HEH?
WELL, IT'LL COST YOU. TODAY MY FEES ARE:

  BLAST  1429
  HEAL    476
  POWER    48
  SPEED  2381

WELL, WHICH WILL IT BE?'

(HIT THE KEY FOR YOUR SPELL, B,H,S OR P)
  POWER

HOKAS TEACHES YOU YOUR SPELL, TAKES
HIS FEE, AND RETURNS TO HIS STOOL ON
THE BAR.  AS YOU WALK AWAY YOU HEAR
HIM ORDER A DOUBLE DRAGON BLOMB.

AS YOU WANDER ABOUT THE HALL, YOU
REALIZE YOU CAN DO ONE OF SIX THINGS--
  1.  GO ON AN ADVENTURE.
  2.  VISIT THE WEAPON SHOP FOR WEAPONS
      AND/OR ARMOUR.
  3.  HIRE A WIZARD TO TEACH YOU SOME
      SPELLS.
  4.  FIND THE BANKER TO DEPOSIT OR
      WITHDRAW SOME GOLD.
  5.  EXAMINE YOUR ABILITIES.
  6.  TEMPORARILY LEAVE THE UNIVERSE.

(HIT THE KEY FOR YOUR CHOICE, 1-6)1

INSERT DISKETTE WITH ADVENTURE (OR KEEP

THIS DISKETTE FOR BEGINNERS CAVE) IN

DISK DRIVE IN SLOT SIX, DRIVE ONE THEN

HIT 'C'

YOUR COMMAND? FLEE

YOU ARE STANDING IN
  THE MIDDLE OF A LONG PASSAGE

  >> HEINRICH IS HERE.
  >> WOLF IS HERE.

YOUR COMMAND? FLEE

  YOU ARE IN A SMALL, STARK CELL WITH A
DOOR ON THE WEST SIDE.

  >> HEINRICH IS HERE.
IN THE ROOM IS A CAVE MAN, ROASTING A
DEAD RAT OVER A TINY FIRE. HE IS DRESSED
IN ANCIENT HIDES, AND HAS A BIG CLUB ON
THE FLOOR NEXT TO HIM. HE SEES YOU AND
SMILES. 'FAT ADVENTURER,' HE SAYS. 'YUM
YUM.'

YOUR COMMAND? ATTACK CAVE MAN
MARCUS ANTONIUS ATTACKS CAVE MAN
  --A HIT!

CAVE MAN TAKES DAMAGE BUT
   IS STILL IN GOOD SHAPE.
HEINRICH ATTACKS CAVE MAN
  --A MISS.
CAVE MAN ATTACKS MARCUS ANTONIUS
  --A MISS.

YOU ARE STANDING IN
  AN EAST CELL

  >> HEINRICH IS HERE.
  >> CAVE MAN IS HERE.

YOUR COMMAND?
                  ATTACK CAVE MAN
MARCUS ANTONIUS ATTACKS CAVE MAN
  --A CRITICAL HIT!

CAVE MAN IS VERY BADLY INJURED.
HEINRICH ATTACKS CAVE MAN
  --A MISS.
CAVE MAN ATTACKS MARCUS ANTONIUS
  --A FUMBLE!
   WEAPON DROPPED!


YOU ARE STANDING IN
  AN EAST CELL

  >> HEINRICH IS HERE.
  >> CAVE MAN IS HERE.
YOU SEE THE CAVE MAN'S CLUB. IT'S A HUGE
PIECE OF WOOD, BOUND WITH IRON BANDS.

YOUR COMMAND? S

  YOU'RE IN THE MIDDLE OF THE LONG HALL.
DOORS ARE BOLTED ON BOTH SIDES OF YOU
(EAST AND WEST).  THE HALL EXTENDS NORTH
AND SOUTH.

  >> HEINRICH IS HERE.

YOUR COMMAND? W

  YOU ARE IN A SMALL, STARK CELL WITH A
DOOR ON THE EAST SIDE.

  >> HEINRICH IS HERE.
IN THE ROOM IS A HUGE WOLF. IT JUMPS UP
FROM WHERE IT WAS SLEEPING, AND BARES
ITS LONG YELLOW FANGS.


YOUR COMMAND? ATTACK WOLB
MARCUS ANTONIUS ATTACKS WOLF
  --A MISS.
HEINRICH ATTACKS WOLF
  --A MISS.
WOLF ATTACKS MARCUS ANTONIUS
  --A MISS.

YOU ARE STANDING IN
  A WEST CELL

  >> HEINRICH IS HERE.
  >> WOLF IS HERE.

YOUR COMMAND?
                  ATTACK WOLF
MARCUS ANTONIUS ATTACKS WOLF
  --A MISS.
HEINRICH ATTACKS WOLF
  --A MISS.
WOLF ATTACKS MARCUS ANTONIUS
  --A MISS.

YOU ARE STANDING IN
  A WEST CELL

  >> HEINRICH IS HERE.
  >> WOLF IS HERE.

YOUR COMMAND?
                      ATTACK WOLF
MARCUS ANTONIUS ATTACKS WOLF
  --A MISS.
HEINRICH ATTACKS WOLF
  --A MISS.
WOLF ATTACKS MARCUS ANTONIUS
  --A MISS.

YOU ARE STANDING IN
  A WEST CELL

  >> HEINRICH IS HERE.
  >> WOLF IS HERE.
```

Figure 2: The Known Eamon *Adventures.*

No.	Name	AAA No.
1	Master Disk & The Beginners' Cave	E01
2	The Lair of the Minotaur	E02
3	The Cave of the Mind	E03
4	The Zephur Riverventure	E04
5	The Castle of Doom	E05
6	The Death Star	E06
7	The Devil's Tomb	E07
8	The Abductor's Quarters	E08
9	Assault on the Clone Master	E09
10	The Magic Kingdom	E10
11	The Tomb of Molinar	E11
12	The Quest for Trezore	E12
13	The Caves of Treasure Island	E15
14	Furioso	E16
15	Heroes Castle	—
16	The Caves of Mondamen	E17
17	Merlin's Castle	—
18	Hogarth Castle	—
19	The Death Trap	—
20	The Black Death	E20
22	The Senator's Chambers	E19
23	The Temple of Ngurct	E18
—	The Lost Island of Apple	E13
—	The Underground City	E14
	Dungeon Designer's Diskette	EDD
	EAMON Utilities	EU

The numbers in the left-hand column are the ones John Nelson uses. The ones on the right are the AAA catalog numbers.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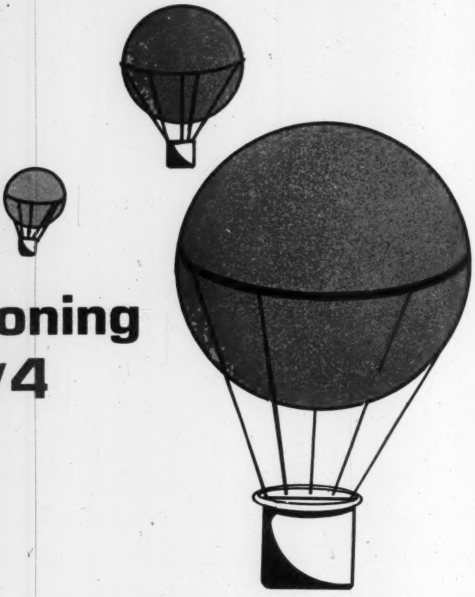

Hot Air Ballooning With The 99/4

Robert Cashman

Have you ever wanted to operate your own hot air balloon? You can do just that with a new program from Simulsoft called *Aeronaut*. It was written by Al Kanda in TI Extended Basic and is a simulation of the sport of hot air ballooning.

When I saw that the program was written in TI Extended Basic, I expected to see some fast moving and detailed graphics. What program written in TI Extended Basic doesn't make use of sprites in motion? As I read the accompanying instruction manual, I began to think that I was going to be disappointed.

On page 3 of the manual, there was a paragraph describing the program. In part it reads: "This program should not be judged on the basis of entertainment value alone (it may in fact seem slow to one accustomed to a steady diet of arcade-style games) but also on the basis of the unique experience it provides. The intent is for you to be an aeronaut while you are running this program and experience what it is like to fly a balloon."

OK, what would you experience if you were to fly in a balloon? Why don't we go on an imaginary ride? I suppose it would be something like this. Once the balloon is inflated to an upright position, we turn on the blast valve of the burner to increase the temperature in the balloon. This makes us airborne and off we go.

Because we want to obtain a certain height, we open our blast valve and keep it open until we reach our desired altitude. Not too much heat in the balloon now. We don't want it to overheat.

Boy, I'm glad we picked a beatiful day to go. You can see for miles. Doesn't the countryside look terrific from up here? Look! There's the town hall, and over there is the church steeple. Look how small they are! Ahh, this is great. Just floating by. No engine sounds. No control of direction. The wind just taking us where it will.

creative computing
SOFTWARE PROFILE

Name: Aeronaut

Type: Game

System: TI99/4 or TI99/4A

Format: Cassette

Language: TI Extended Basic

Summary: A simulation of hot air ballooning

Price: $19.95

Manufacturer:

Simulsoft Computer Software
Box 3494
Scottsdale, AZ 85257

Can Aeronaut really stimulate our imaginary ride? Yes and no. First of all, the program is extremely technical in its approach to familiarizing the user with the sport.

After a nice introduction on your screen, both graphically and musically, you are asked if you want instructions. By pressing Y, you get facts about your balloon — facts such as its volume is 56,000 cubic feet and it has an 11 Mega-BTU/hour burner. You have 20 gallons of propane fuel. The maximum temperature your balloon can accommodate is 250°F. And your maximum payload is 650 pounds at sea level and 70°F derate 8 pounds per degree over 70°. The manual explains these facts further, but it would not hurt to brush up on your physics.

Running The Simulation

Next, you press ENTER for a display of your flight instruments. Here you find your variometer, pyrometer, altimeter, fuel level indicator, and compass. The variometer is for vertical velocity. It reads positive when you are ascending and negative when you are descending. The pyrometer reads the balloon temperature. The altimeter reads your altitude. The fuel level indicator keeps track of the amount of propane used. The compass indicates your heading.

Next, press ENTER for displays. These include the ambient temperature; the wind speed/direction, which is displayed in knots; and the direction in degrees from which the wind is blowing,

---

Robert W. Cashman, 11 Hallenan Ave., Lawrence, MA 01841.

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Aeronaut, continued...

which is measured clockwise from north. The distance drifted is the distance that your balloon is carried by the wind and is measured in feet from the launch site.

The display section also mentions that your height relative to the terrain along your flight path is displayed here. When your altitude exceeds 1550 feet, the display scale changes. In other words, at 1550 feet your balloon disappears from your monitor. It is at this time that the scale of what you were looking at changes so that you can once again have the balloon and the terrain on your screen together.

Pressing ENTER again gets you your control keys. The spacebar turns your burner on allowing you to ascend. If you want to descend, simply allow the balloon to cool. Should you want to descend in a hurry, press M. This opens the maneuvering vent to release hot air. Pressing D opens the deflation port to deflate the balloon rapidly after landing so it won't be dragged along the ground. Pressing Q allows you to quit or abort a launch. Pressing T allows you to switch fuel tanks.

The next areas discussed are your preparation for launch, inflation and lift off, display boundaries, and landing. As all of these areas are discussed at length in the manual, I will not describe them here.

Now that we are ready for our trip, let's discuss the object of this simulation. The object is to travel in your balloon over terrain which includes obstacles without crashing or being shot down. The obstacles include a couple of small mountains, a large mountain, a fruit orchard, some power transmission lines, and a military base by the name of Yellow Sands Proving Grounds. The balloon crashes if it collides with any slope or ground obstacle, or if he makes ground contact at a downward velocity in excess of 800 feet/minute. The balloon will be destroyed by heat-seeking missiles if the distance drifted is greater than 24,800 feet.

Evaluation

Now Simulsoft never called this program a game. It is a simulation. I suppose that means it should be considered as a realistic adventure in a hot air balloon.

Aeronaut succeeds in the technical aspects as it acquaints the user with the sport of hot air ballooning. But at the same time it fails to stimulate the desire to ever partake in such an adventure.

As mentioned during our imaginary trip, much of the excitement of ballooning comes from the sensation of the panoramic views below — being on top of the world. *Aeronaut* does not simulate this.

Let's look at the program from an entertainment point of view. If there is no panoramic scenery, what is there to hold the user's interest? The main thing is the realization that if I don't properly control the valve, I'll crash. It is unfortunate that obstacles that would require a spontaneous reaction were not included. It would have made *Aeronaut* much more fascinating. What type of obstacles? How about a sudden thunderstorm complete with lightning and torrential rains? Or a flock of birds coming right at you? I think you get the idea.

It is apparent that Mr. Kanda and Simulsoft spent a great deal of time and effort in producing this program. As the owner of a TI99/4, I appreciate their developing software. I do, however, wish that they had taken the program a couple of steps farther toward a more realistic simulation. ☐

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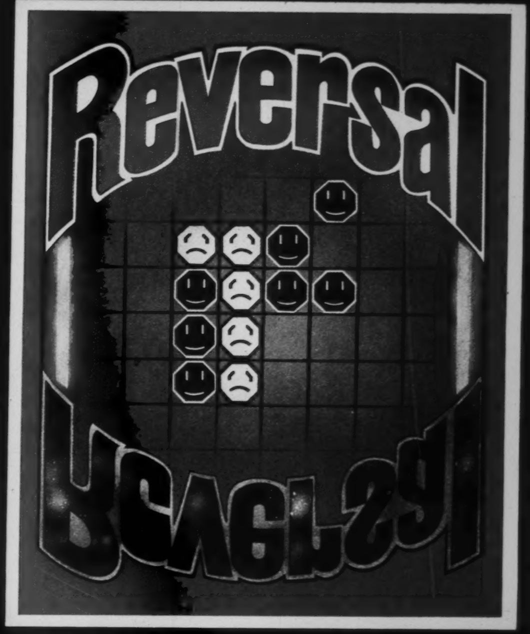

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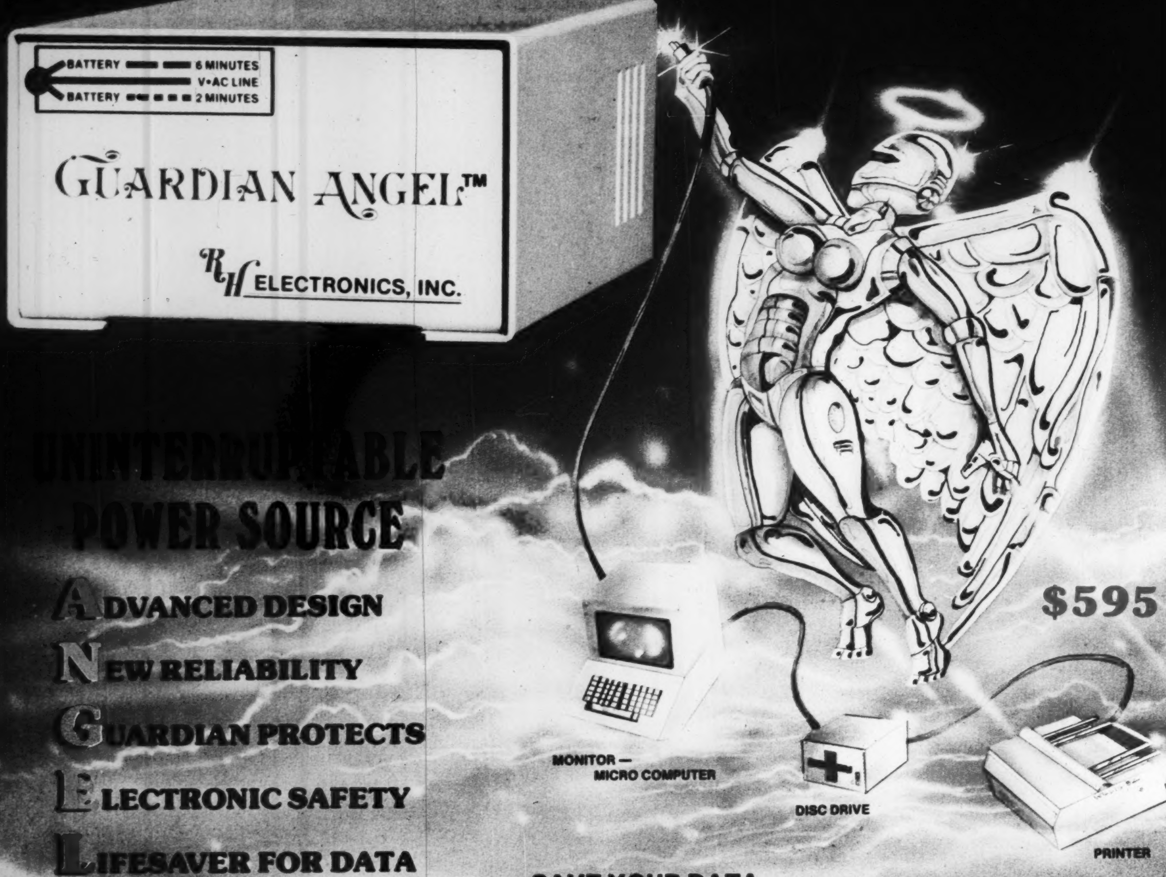

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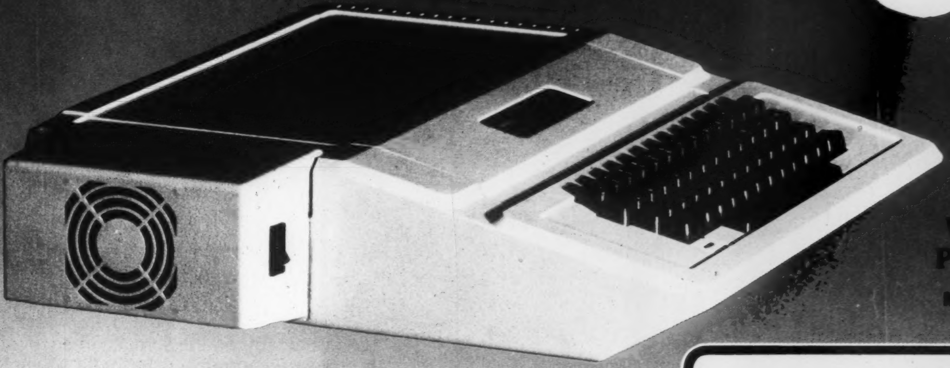

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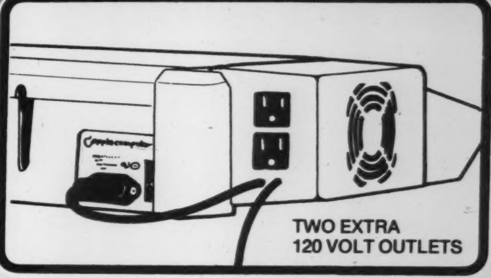

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Wayne Hixson and Sheldon Leeman

Cypher Bowl

"OK, Hixson. Zorn's hurt and out for the rest of the game. You're our man—now go out there and get 7!"

"Coach, you can count on me... Guys, its a 32 Up and Out. Largent, I'll be looking for you at the five. Break!"

A wild fantasy from the deranged mind of a short, slow, and (slightly) overweight sports nut? Not entirely—not with my Atari 800 and *Cypher Bowl,* an excellent two-player football game program by Bill Depew. Now we would-be jocks can step into the electronic shoes of a Jim Zorn, a Walter Payton, or a Jack Lambert to live our fondest fantasies in perfect safety. No injuries, unless you count acute "controller thumb," a malady now surpassing tennis elbow in popularity.

Cypher Bowl is attractively packaged in a sturdy, colorfully illustrated box. Both cassette and diskette versions are included (they are the same). The documentation is very good. The user manual explains the game clearly and gives good tips on playing techniques. Two playcards are included, laminated in plastic to withstand a lot of handling. Each playcard includes the offensive and defensive formations and plays. Sketches of each play show the patterns that the receivers, blockers, and defenders will run.

Once you have read the instructions and studied the plays, the game can begin. The program is self-booting and no cartridge is needed. The opening display is of the title, manufacturer, copyright notice, and a portion of the field. The crowd roars, and you're ready to go! Pressing any key turns on the standard display.

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SOFTWARE PROFILE

Name: Cypher Bowl
Type: Football Simulation
System: Atari 400 or 800, 16K
Format: Disk or Cassette

Language: Machine language
Summary: Excellent combination of strategy and action
Price: $49.95
Manufacturer:
Artsci, Inc.
10432 Burbank Blvd.
N. Hollywood, CA 91601

In the center of the screen are the field and the two five-man teams. You have a blimp's-eye view of the field, which runs vertically on the screen. The view is always centered on the ball. About 30 yards of the field are visible. The score, quarter, and time remaining are displayed on the top of the screen. On the bottom are the down, yards to go, and the time-outs remaining.

The game is played in four simulated 8-minute quarters. There is no kick-off. The blue team starts with the ball on their 20-yard line, with the white team defending the top of the screen. Each player begins by selecting one of four formations from the playcards. On offense, you can spread your receivers, or play them in tight. The defense can put everyone up front, or drop up to three players back to play pass defense. After both have chosen, the teams move into position.

The players scrutinize each other's calls, then pick one of four possible plays allowed for the particular formation. Offensive possibilities range from quick openers to the bomb. The defense can opt for a strong pass, strong run, or balanced defense. What you choose depends on the formation your opponent unveils. For example, if you call a defense strong against the run and the offense deploys in a spread formation, you can still make the best of it by calling a zone defense to protect against the probable pass. However, your chances are poorer than if you had elected a strong pass defense formation to begin with.

Wayne E. Hixson, 115 NW 39th Street, Seattle, WA 98107.
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This method of play calling is well thought out and superior to the other games I have played. Both players have options after they see the other's call, instead of the defense only.

Another nice touch is the way *Cypher Bowl* handles the 30-second clock. There is no delay of game penalty, but the clock is automatically stopped after 30 seconds until the play commences.

> ***If you make the right call, your left end will take the right line-backer out of the play, and leave a hole a truck could drive through.***

The *Cypher Bowl* clock also stops between quarters, for the two-minute warning, for time-outs called by the players, and on incomplete passes and out of bounds plays.

After selection is complete, play is initiated as the offensive player moves the joystick. Instantly, the scoreboard information disappears and your view of the field increases to fifty yards. This is especially nice on pass plays, as the receivers would soon run out of view otherwise. During play, the offensive player controls the quarterback or the receiver, whichever has the ball.

As the manual points out, it is easier if you visualize yourself as controlling the ball, with the player coming along for the ride. On defense, you control the middle linebacker. The remaining eight players are controlled by the computer, following the patterns shown on the playcard.

Think about that for a moment. A total of ten players, moving in individual patterns. How? Aren't there only four players in Atari Player/Missile graphics? Yes, but *Cypher Bowl* shows just what a good programmer can do with this system. In order to get more than four players, single players are moved to different screen locations between TV frames, every 1/60 second. The images alternate so fast that the eye can't discern the change, except for some minor flickering.

As a result of the individual control of each player, blocking, passing, and pass coverage patterns are exceptionally realistic. If you make the right call, your left end will take the right linebacker out of the play and leave a hole a truck could drive through. However, if your opponent outguesses you and fills that area, you will be lucky to get back to the line of scrimmage.

Cypher Bowl excels in its simulation of the passing game. This was also the hardest part of the game to learn. Not only do you have control of passing direction, you must also control distance. In the other games I have played, a thrown ball will travel indefinitely, until it hits a receiver or defender, or goes out of bounds. Any eligible receiver (offense or defense) in the path of the ball will catch it, whether 6 or 60 yards from the quarterback.

Cypher Bowl adds a third dimension —height of the ball above the ground. Now you can throw the ball over the head of the defender. Of course, this also enables you to overthrow your own man, which I have been able to do very consistently. A pass is launched by pressing the joystick button and pushing the stick toward the target. The distance is determined by how long you hold the button down.

The height of the ball cannot be shown on the screen, so sound is used. A rising tone indicates a rising ball, and vice-versa. Once thrown, you can control the direction of flight with the joystick to "fine tune" it to the receiver. I think that this is one weak point of the program. The ball is too controllable. You can start it toward one sideline and then steer it clear across the field, or even reverse it back toward the quarterback. The magnitude of control should be reduced to a little nudging.

Another superior feature of *Cypher Bowl* is the option to throw to either of two receivers on most plays. You also have some control of the receivers on pass plays. Once the ball starts its downward flight, pressing the joystick button causes the receivers to break off their patterns and move back toward the ball.

As you can imagine, orchestrating all this activity in the period of about two seconds requires a lot of practice, but what a feeling when you float the ball over an onrushing linebacker to the tight end cutting back in front of the safety. A caution—there is only a five to seven yard window in which the receiver can catch the ball. If you overthrow, the defender is likely to get it.

You might think all this control would make an accomplished player unstoppable. Not so! This game provides a few tricks for the defense as well. If your defensive linemen get within a few yards of the quarterback before he throws, the ball will be batted down. Once the ball is in the air, you can make your defensive backs cut toward it by pressing the joystick button. All in all, the offensive/defensive balance is good.

The kicking game is good. The ball is kicked by pressing the button. Instead of going a random distance, the longer you wait before you press the button, the farther the ball will go. A split second too long, though, and it will be blocked. There is no difference between a field goal and a punt. If the ball goes between the uprights, it's worth 3 points.

I have played *Cypher Bowl* for over 30 hours now, and the more I play, the more I like it. The realism is a step above the other games I have played. The graphics, in spite of the lack of detail, are quite good. Player/Missile graphics, fine scrolling, and mixed modes are used very effectively. The animation is both smooth and fast.

The playability is good, and it's not an easy game to master. I'm still below 50% in the passing game, but I'm getting better. I think it is this continuing challenge in any game that keeps you playing it, along with the fun.

In summary, this is a worthwhile game. If you're a "stats junkie," it probably won't be your cup of tea, but if you like a sports game that makes you think and participate, I believe you'll love this one.

Now, guys, how about a solitaire version? I have a hard time finding opponents during my normal game-playing hours. *—WH*

Krazy Antiks

Don't be confused by the pun. The Antic that everyone associates with Atari computers is the support chip that makes possible the superb graphics needed for all of those neat arcade-type games. The Antiks in the title of this product refers to the insect you need in order to have a picnic. When the two get together, you wind up with a neat arcade-type game with great graphics, and everyone has a picnic.

Krazy Antiks is the fourth game cartridge released for the Atari 400/800 computers, and it bucks the trend of "me-too" arcade-style games. Lately it seems that everyone is trying to cash in on the arcade craze by serving the warmed-over remains to computer owners. Even K-Byte's earlier ventures into game programming tended to follow the heavily beaten path. But *Antiks* has just enough of a twist to be considered a new idea in a market saturated with retreads.

I must concede that the locale of the action is nothing novel—the ant hill in question strongly resembles the type of maze used in any number of games spawned by that prolific procreator,

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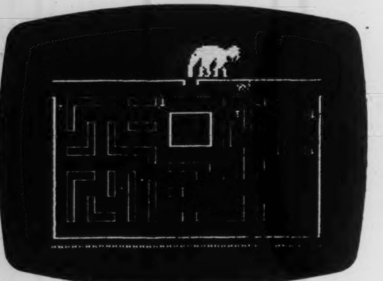
Action and Antiks, continued...

Pac-Man. But the scenario is a fresh one.

You play the role of the White Ant, and your purpose is one familiar to students of biology—to perpetuate the species. You start the game with about 30 eggs, which represent your capacity to reproduce, at the bottom of the screen.

Arrayed against you are several adversaries. First, one ant each of the four basic ant types—yellow, blue, green, and red—circulate around the maze, trying to devour you. Another natural enemy is the dreaded anteater, who strolls into the picture every so often and sticks his tongue into the anthill, sucking up friend and foe, ant and egg alike. Finally, periodically a rain shower turns the lower part of the anthill into a disaster area, minus the federal aid.



With the odds against her, the lone ant has little chance for survival. Fortunately, if she can find a safe place in the maze in which to lay an egg where it will not be eaten by another ant, after she is gone, the egg will hatch, and another white ant will take her place. Moreover, she has a weapon she can use.

The other ants are busy laying eggs also, and when she eats one of theirs, she begins to glow, letting you know that the next egg she lays will be deadly to the other ants, if laid directly in their path. At each level, play continues until the white ant is killed, without leaving any eggs in the maze, or until all four of the other ants have been killed without surviving offspring.

If the latter occurs, the game proceeds to the next level, and four new enemy ants come marching in to the tune of "When Johnny comes Marching Home" (which some like to think of as "The Ants Go Marching Two by Two").

Each maze has 99 levels of difficulty. If that fails to provide enough variation, there are six different maze configurations to try out.

Krazy Antiks rates a high score for playability. Even an experienced player can get caught early on by a freak accident, which inevitably leads to "just one more" game. There is a pause option, for those disturbed by the inconsiderate intrusions of friends and family. Unfortunately, there is no multi-player option. But if you don't mind going it alone, you'll bless the day when ant met Antic.

—SL

creative computing

SOFTWARE PROFILE

Name: K-razy Antiks
Type: Arcade
System: Atari 400/800 16K
Format: ROM cartridge
Language: Machine
Summary: Puts ants in your pants
Price: $39.95
Manufacturer:

CBS Software
Columbia Group, CBS Inc.
Hagerstown, MD 21740

METEOR STORM

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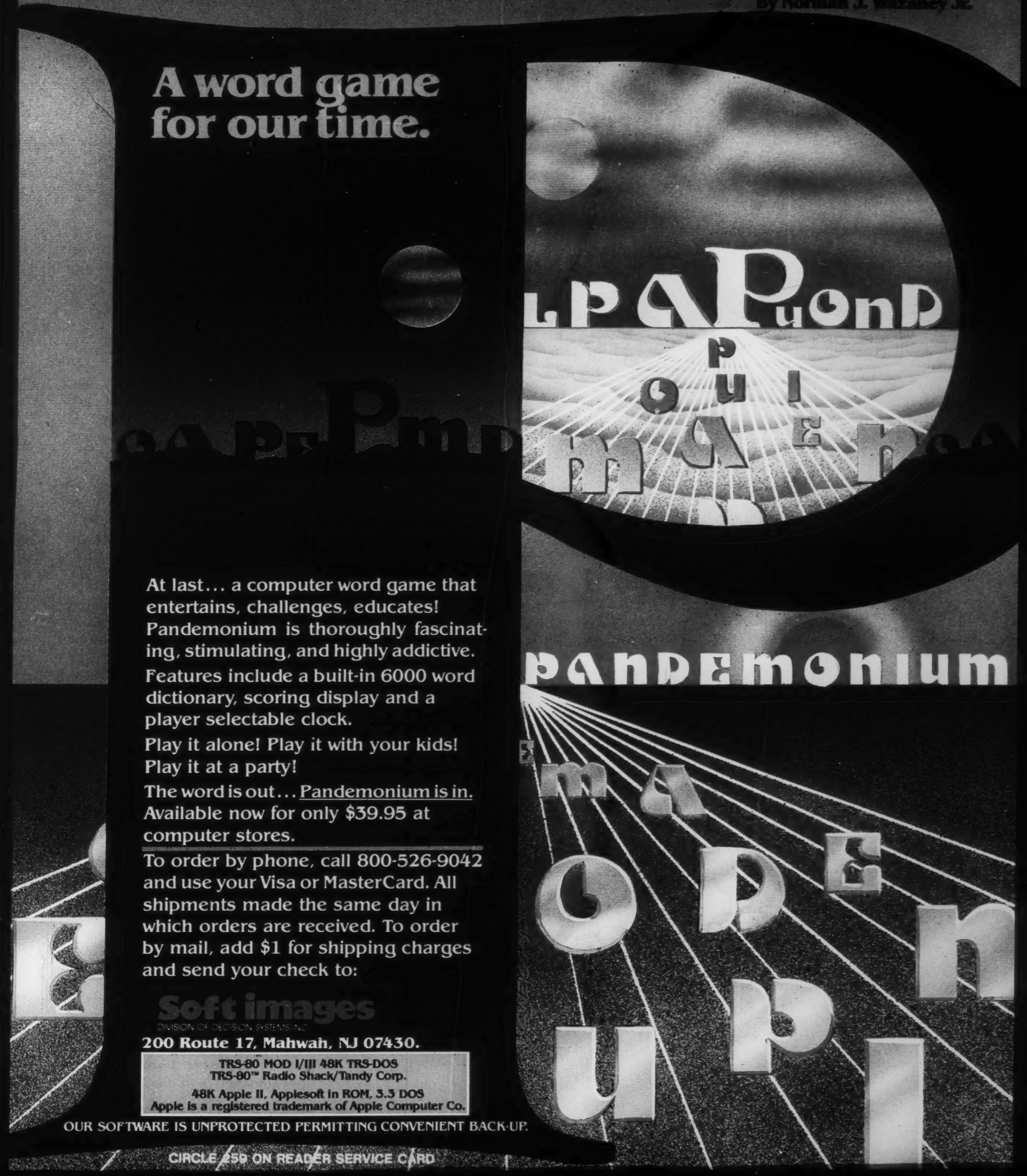
By Norman J. Wazaney Jr.



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CIRCLE 259 ON READER SERVICE CARD

Report From The Fourth Personal Computer World Show

Dragons, Acorns, and Other Micro-Innovations

Guy Kewney

I'm starting to have this vision of the computer of the future — one which shows it as a sort of puppet master, manipulating and directing external storage, external displays, external audio, external communications, and the like.

But unlike a puppet master, this computer will have nothing like the power of the things it controls.

This (perhaps unnecessary) philosophising was brought on by the most impressive display add-on I have seen, at the Personal Computer World Show in London.

In fact the device, called Pluto, is making me wonder whether graphics might not be just as versatile, useful, and profitable an area as microcomputers have shown they can be.

Pluto is a video plotter capable of drawing 100,000 pixels per second. It uses 192K of very fast storage to do this, and has its own Intel 8088 chip (the one inside the IBM PC, the Digital Rainbow, and the Victor 9000) to control it.

PLUTO
WITH
APPLE
GEMINI
IBM
NASCOM
PET
SIRIUS
RML
PLUTO
PALETTE
16,000,000
COLOURS
PLUTO
COLOUR

The Pluto video plotter can draw 100,000 pixels per second. 16,000,000 colors is a bit of an exageration; 256 is more like it but still a lot.

The really interesting thing about it is not just the detail, nor the speed, nor even the fact that each pixel can have its choice of any of 256 colours.

It is the £600 sterling price tag which the little box was carrying, when it appeared at the show in London recently.

The really worrying thing about it is not the fact that this is less than the cost of an arcade games machine with a considerably lower screen precision and considerably slower computation — but the things that people are planning to do with it.

According to designer Graham Rowan, head of IO Research in London, the device has been keenly examined by writers of ordinary business software. They have, he says "all gone away talking rapidly about the things they plan to do by enhancing their business programs with fast changing graphics."

The reaction is one micro pioneers will recall from the days when we all saw our first microcomputer running Tiny Basic — the reaction which says "Hey, this isn't marvellous; it's useful!"

On top of that, Rowan has been approached by advertising graphics designers, CAD specialists, entertainers, and a wildly varying host of different types all united only in their conviction that this is what they have been looking for without knowing it.

In particular, a local company called Robocom is connecting its BitStik to the Pluto. BitStik is nothing more than a swanky games joystick, used to move a rectangular "frame" around a display screen. The frame can be enlarged, and can be focussed onto the smallest detail on the screen. Then, that small detail can be expanded to fill the whole screen. Again, the frame can be focussed on a small detail, and that detail enlarged.

The BitStik can be used to draw, to position pre-drawn details, and to position color fill. Coupled with the incredibly accurate and fast color display of Pluto, the potential for designers makes the integrated circuit design machinery of the last ten years look primitive.

So far it has been interfaced to most popular micros available here, and the designers say that adding a new machine is the work of a few weeks only.

Micronet 800

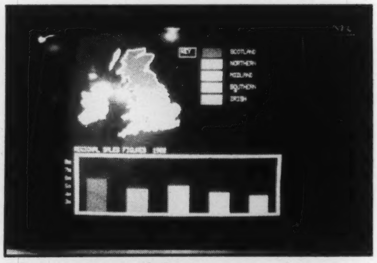
The other big step forward for visitors to the PCW Show, was the arrival of Micronet 800.

There is no relationship between Micronet in America, and Micronet 800 in Britain, other than the name and the fact that they are aiming to do the same thing — provide an information handling and forwarding utility.

The basis of the British scheme is the famous Prestel (now called Teletex in fashionable circles) network which British Telecom, the old Post Office, set up in vain hopes of turning the country's TV sets into terminals.

It has at last dawned on them that it is easier to turn a pretty smart computer into a teletex receiver/transmitter, than to use an ordinary domestic television as a data display/responder.

By joining forces with an enterprising local businessman called Richard Hease, the Prestel authorities may have brought their baby out of its birth coma at last. Hease has fingers in publishing, and in computer retailing, being the first distributor to be appointed by Clive Sinclair here. Normally, Sinclair restricts himself to selling through the mail, or a chain of stationery stores, W. H. Smith.



Pluto generated the image on the screen faster than you can read this caption.

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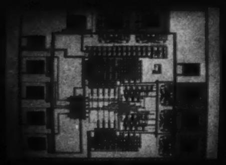

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PCW Show, continued...

His plan is to have a big database of free software, predominantly games, and to sell a £1 sterling per week subscription to owners of popular micros, which will enable them to use Prestel as their program storage area.

Any program held on Prestel can be downloaded, say the Micronet 800 people, in far less time than it takes from tape, and very reliably. The key to the scheme, of course, is the cost of connecting a computer to the phone.

The big breakthrough that Hease and his colleague Bob Denton hope will be ready for the official launch in January, is a £50 sterling modem plus interface, suitable for the Sinclair ZX81 and similarly cheap micros.

And for the bigger machines, they hope still to keep the hardware solution to around £100 Sterling.

If the plan works, and Micronet 800 manages to recruit the necessary 10,000 subscribers by June, Prestel will take one of its spare computers out of mothballs, where it has spent the last year waiting for the expected boom in teletex. Hease will then be able to start using the network to sell business software on a "try it on the screen, order it through the network" basis. Electronic mail will be free after business hours, but profitable during peak time.

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This is Prestel

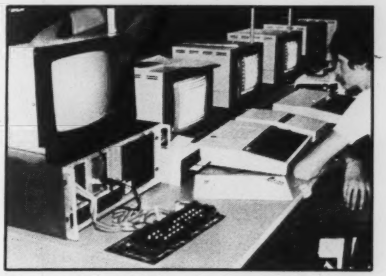
Bob Denton of Micronet 800 aims to sign up 10,000 subscribers for £1 per week to download software, mainly games, from a huge central database.

At the Show, Micronet 800 were demonstrating several simple software download routines, which actually appeared to work.

Acorn Econet

Even more impressive to the visitor, however, was the Acorn stand, where the maker of the BBC Microcomputer was demonstrating local networking.

Acorn's Econet was evolved in response to classroom needs — where one machine is useless, and simple multi-keyboard access even more so. Econet gives every Acorn processor (it makes two, the BBC and the Atom) access to a central file server with hard or floppy disks, and freedom to use an area of that disk system as its own. In addition, it allows the file server to monitor each node, copy the screen at that node, and observe what system calls are being made. If necessary, the master system can be transferred to any node.



Econet from Acorn allowed both Atom and BBC machines access to a central file server (left foreground) of hard or floppy disks.

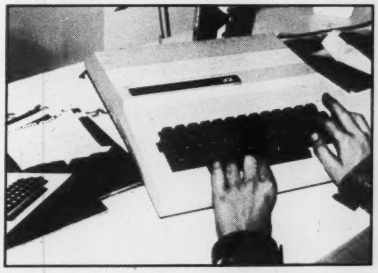
Best-seller of the show was an Acorn machine, the expanded Model B of the BBC micro. It was in plentiful supply, despite a chronic shortage of machines from Acorn. Where, asked angry users, were these machines coming from, when they had all been waiting up to nine months for their own models?

The answer, it seems, was that certain dealers who were out of patience with Acorn's slowness in building up volume production, had taken matters into their own hands. They had ordered the upgrade parts, paid money for the readily available Model A, and had done the conversion themselves.

This perfectly plausible explanation failed to satisfy many, who went about muttering about black markets and corruption in official circles. Others, more practically minded, switched their orders to a machine called the Dragon.

The Dragon

This was also selling well at the show, being essentially a Tandy Color Computer for £200 sterling. The machine is so essentially a color computer that it will, if you take a color computer cartridge and file off the bumps, run most Tandy cartridge games.



The Dragon 32 is a British-made computer that is software compatible with the Tandy (Radio Shack) Color Computer.

It proves how wrong Tandy has been by being so reluctant to let anybody other than a Tandy store sell Tandy micros. Britain is sparsely supplied with the Texas company's outlets, and sales are proportionately lower than in the U.S. Everybody knows this, it seems, except Tandy, whose British executives resolutely insist that its products sell entirely on merit, and that distribution has nothing to do with it.

The Show

The show itself was a great success in its own right. People through the door were counted at over 50,000, making this the biggest micro show in the world now, and all that is really needed is a better venue.

EOS (Electronic Office Systems) had an immense stand (booth) at which they were showing an impressive array of hardware and software, mostly for the IBM PC.

The Barbican has space enough for the exhibitors, but not for the visitors — not surprising, as the building was put up as a multi-story car park, before it was discovered that there was more demand for exhibition space than car parking.

Organizers of the show still fail to arrange a trade-only day. Pressure from disgruntled exhibitors will certainly lead to that mistake ending next year.

Finding another venue, however, won't be so easy. It is a matter of dubious legality, but a rival exhibition organizer is able to prevent any other computer show besides its own from behing held at either Earls Court or Olympia stadia, under the terms of its contract with the hall owners.

The owners have a virtual monopoly of suitable sites in London. Until somebody with the money needed to challenge this monopoly in the courts steps forward, PCW must choose between London and comfort. And for the next year, at least, London will be the higher priority. □

Random Observations On Life In England

Telephones, Toilets and Car Parks

Betsy Staples

Last year in our report on the Personal Computer World Show we commented on, among other things, the showers and telephones in England. The showers haven't changed much, but here we bring you an update on phones and other items of interest to readers who want to learn about life beyond Harrods and the Inter-Continental.

This year, I, liberated, independent woman of the world that I am, flew to England alone, rented a tiny Ford Fiesta, and set off to see the countryside.

The few difficulties I had driving on the right side of the road were the result mainly of my preconceived terror. It wasn't bad at all. But then, I can't tell my left from my right, don't know which way faucets are supposed to turn, and have to think every time I unlock my front door.

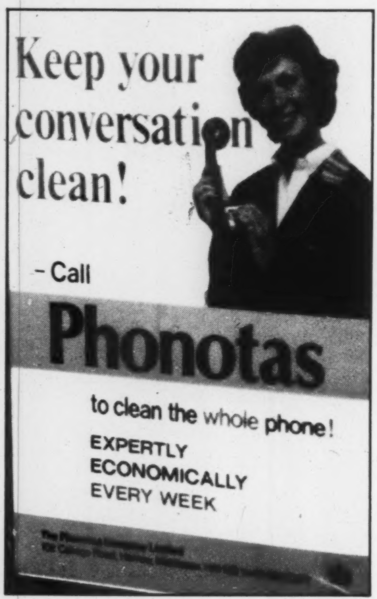
I drove to Oxford and staggered into a 400-year-old inn with 6½' ceilings and stairs of different heights. As I chatted with the proprietor, he suddenly lowered his voice to a confidential whisper and asked, "Why are you traveling alone? Did you have a fight?" I attempted to explain the situation to him, but should have been forewarned; it was a question I was to ask myself more than once in the coming days.

After spending a day each in Oxford, Bath, and Salisbury, I concluded that traveling alone is for people made of sterner stuff. It just wasn't fun, and I all but gave up eating, so distasteful did I find sitting alone in strange restaurants.

Parking the Car

Thanks to my rented car, I did discover an interesting British innovation that I had not noticed on previous trips: automatic car parks, as parking lots are called. The best kind provides a numbered card from the automatic card-spitter-outer at the gate. As you leave, you stop the car at a little check-out station right before the exit gate. You enter the number of your card through a membrane keyboard, the display flashes the amount you owe, you desposit the correct amount, the gate rises, and you drive away.

The other kind is similar to our metered lots, the main difference being that there are only three or four meters per lot or level. You park your car, walk to the nearest meter, set a dial for the amount of time you plan to stay, and deposit the indicated amount of money. A slip of paper with a bit of stickiness on the front emerges from the machine. You then return to your car and stick the paper to your windshield. I never saw anyone patrolling or checking these lots. I suppose they rely on the innate honesty of the British people.



It does strike me as strange that a country with such a high rate of unemployment which has failed to automate some of the lowliest functions known to man, would eliminate such a good source of low level jobs.

Cleaning the Toilet

And speaking of automation and low level jobs, there is in London at least one automatic toilet. David Tebbutt of Caxton Software took us (by this time I had met Dave Ahl in London) to the ultimate in modern sanitation right on the sidewalk in Soho Square. When you place the appropriate coins (about 10 pence, I think) in a slot in the shiny, white, cylindrical structure, a door slides open and you enter a (presumably) sanitary little rest room. When you are ready to leave, the door slides open, you exit, the door closes, and the whole interior (we were told) is hosed down, shaken up, or otherwise washed and sanitized.

There is only one catch. If you stay longer than 15 minutes, the cylinder concludes that something must be wrong, opens the door, and begins its cleaning cycle. Rumor has it that more than one unfortunate soul has been caught with his pants down.

Sanitizing the Phone

Sanitation, it seems, is something which is of great importance to the British people. For example, when was the last time you looked upon your telephone as a vector of disease? Not too recently, right?

Well, here is something to join Toxic Shock Syndrome, Extra Strength Tylenol and Copperheads in Northern New Jersey on the list of "Things We Never Had to Worry About Before": filthy phones.

The first time I saw the cheery Phonotas woman on a poster in an Underground station I thought it was a joke. "Keep your conversation clean!" she urged. "Call Phonotas to clean the whole phone!" Come now, they couldn't be serious.

So incredulous was I that I called the number given on the poster. A very earnest man answered and explained that the service was offered only to businesses and that he could not give me any idea of the cost until one of his representatives had visited our offices and made a thorough survey.

He explained further that Phonotas provides a uniformed cleaner who comes to your office weekly and "sanitizes the receiver against infection." The process takes about one minute per visit per phone "except, of course, the first time when it usually takes longer to get the phone up to scratch."

He asked for my address, promising that a salesperson would call within the week. I hadn't the heart to tell him my office was in Morris Plains, New Jersey, USA, so I mumbled something about calling back when my phone was dirtier and hung up.

My conclusion: the phones in England don't work any better than they did last year, but they must be cleaner. Perhaps that's what has become of all the former parking lot attendants — they have become phone cleaners.

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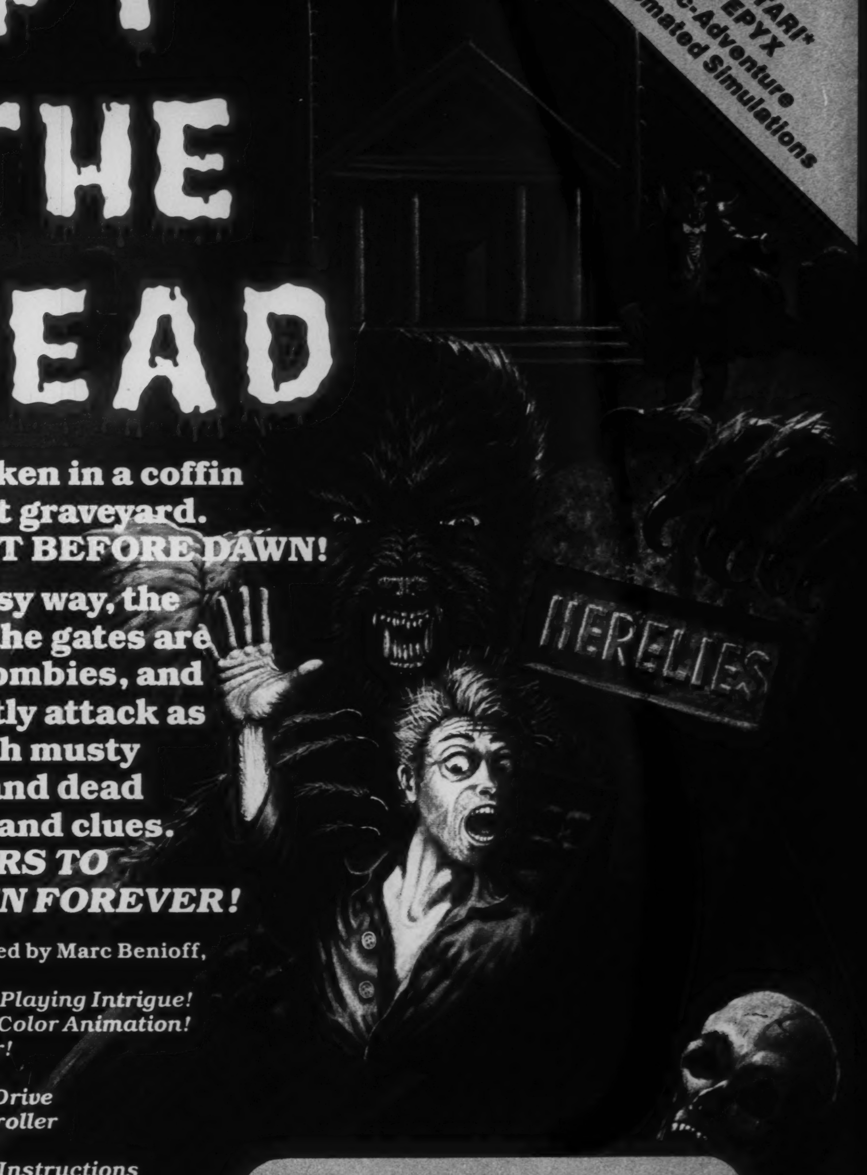

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The Third European Microcomputer Chess Tournament

Anthony Harrington

The Third European Microcomputer chess tournament, held at the Barbican Centre during the PCW exhibition, September 9-12, 1982 proved once again that computer chess is a thriving force.

A seven-round Swiss tournament is always an exciting affair with something of a lottery about it. The basic rule of such a tournament, for those who are unfamiliar with Swiss events, is that winners play winners and losers play losers. Each time the draw is made for a new round, the tournament director tries to pair opponents with the same scores against each other.

Because of this, the going gets easier for the weaker players (programs in this instance) and more and more difficult for those who are doing well. It is a sure way of finding the strongest player/program in the tournament. And it produces some marvellous final rounds.

This year's concluding round was in a class by itself, with the eventual overall winner, Mark Johnson and David Wilson's Advance 2.4, saving its unbeaten record at the last moment by a quirk of fate peculiar to computer chess.

But more of that final round later. Like all chess tournaments, even the human kind, this event began long before any processors found their way into the playing hall in the Barbican Centre.

This year there was an added complication to the usual organisational difficulties that surround such an event. Six months before the tournament was due to begin *PCW* changed hands. Bunch Books, the former owners of *PCW*, who staged the first European tournament back in 1978, sold the magazine to VNU Publications, a Dutch publishing group.

The prototype chessboard for the German machine Bogol (foreground) was built by an excellent craftsman who knew nothing about chess (note the white square in the bottom left corner). Here it is playing against La Regence from David Levy's Intelligent Software Company, the eventual commercial victor.

On top of this change, David Levy, the international chess master, and the man responsible for orgainising the tournament in previous years, decided, quite rightly, that his commercial interests in computer chess programs made it impossible for him to continue to organize the event.

The upshot of all this was that invitations and entry forms went out on short notice, a month before the tournament was due to start. Nevertheless, the tournament attracted a very strong field, totalling 14 entries in all. This was two more than last year, though program failure in the case of two entrants meant that the numbers actually contesting the tournament turned out to be identical.

Commercial Entries

The final line-up included four commercial entries (programs or dedicated chess computers actually on sale to the public or which would be available before the end of the year) and four experimental entries from commercial companies.

It might have been even stronger, but Fidelity, of Miami, FL, whose Sensory Chess Challenger 9 is one of the strongest chess computers around, decided against entering a week before the start. (According to John Renaldo, Fidelity's marketing manager they were considering entering either a commercial model or an experimental entry or both.)

The West German company Hegener and Glaser, who make the Mephisto, also almost entered, but decided at the

---

Anthony Harrington, 81 Hornby Rd., Brighton, England.

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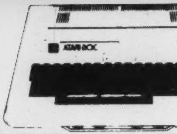

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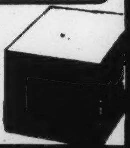

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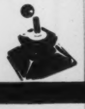

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last moment that they didn't like Swiss tournaments and would concentrate instead on the US World Championships in March 1984.

One has to sympathize with commercial companies. They have a lot at stake as far as potential sales are concerned. And if their machine, for some reason, fails to win one of the top three placings in a tournament it is tempting for their managing directors to feel that the public will take the hint, and buy the machine which did better.

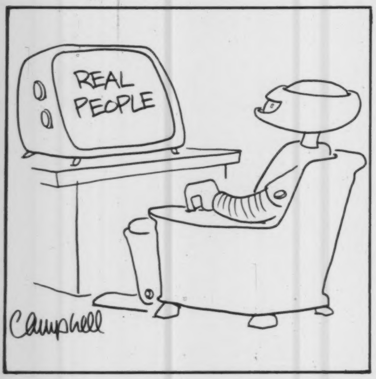
My own feeling here is that they would do better to compete. If they do feel their commercial model is a little delicate, there's no harm in entering an experimental version. It would give their programmers a chance to test their ideas, and the results wouldn't affect their market share, provided the name given to the experimental entry bore no relation to the market model.

Still, if one remembers that the commercial class in the World Championships, held at Lübeck-Travemünde, West Germany, in September last year, consisted of only four entries, one of which withdrew after a few rounds, the commercial line up wasn't bad. And the amateur entries were excellent.

Amateur Entries

It is the amateur entries that make these events. Unburdened by the financial anxieties of the commercial entrants, the amateurs give the tournament its enthusiastic, convivial atmosphere. Whereas commercial competitors have a tendancy to get a little grim at the board and to be sharp and short with opponents, the amateurs tone down the seriousness of it all — and are just as willing to laugh at the odd strange move generated by their own program as they are at their opponent's.

In all there were five amateur entries. From Hamburg, Dieter Steinwender, a computer science student, led a team of four German students with an entry called Micromurks, running on an Apple II.



Also on an Apple II was White Knight (Mk 10), written by Mark Bryant. This, like Richard Lang's Cyrus II, running on an Osborne, was an improved version of a program entered into last year's PCW tournament. Mark Johnson and Dave Wilson, with Advance 2.4 and Jeff Cooper with Chess '86, also seasoned PCW tournament campaigners, completed the amateur turnout.

In passing, one should probably say that the "amateur status" of several of these programmers simply means that they are not selling or about to sell their entry programs, (though they might, if an offer came along). Johnson, Bryant, and Lang are all employed by Intelligent software, a company set up by David Levy and Kevin O'Connell to write and market chess programs (and other intelligent games).

Spectrum Chess from Arctic for the Sinclair ZX81 held its own against much more powerful competitors such as Sci Sys' MK 5.01 experimental entry (foreground).

Experimental Entries

In the experimental commercial class (programs which won't go before the public in their present form), there were two entries by SciSys, the Hong Kong based company whose machine, Mark V, won the Travemünde world championships. These were the Mark 5.01 Experimental and the President Turbo Experimental. The Austrian chess programmer Wim Rens, sponsored by the UK firm Microtrend entered a program called Gambeit '86, and Intelligent Software put in an entry called Philidor.

The commercial section proper, consisted of La Regence, a "sensory-board" chess computer designed by Intelligent Software; another sensory-board machine, called Bogol, by the Hamburg company Omikron (a newcomer to the commercial chess machine market); Spectrum Chess, which runs on the ZX Spectrum, designed by Arctic Computers; and an Irish entry, Conchess, another sensory-board machine.

On the morning of September 9 the competitors assembled in the playing area in the Barbican Centre, set up their machines and programs and promptly experienced the first (and, thankfully, the last) major delay of the event. Someone had wired up a plug incorrectly and blew the fuse for that entire floor sector of the Barbican exhibition hall.

Bear in mind the fact that the tournament was part of the PCW micro exhibition and hundreds of micro suppliers were putting the finishing touches to their stands while we were hunting for an electrician and you will get a fair picture of the start conditions.

Round One

Finally, after a half-hour delay an electrician was found to fix the fault and uncover the culprit, who shall be nameless, and the first round began. The draw and results for the first round are shown in Figure 1.

Play for the whole of this tournament was at the rate of two minutes a move, with the first time control at 30 moves in the first hour and then 23 moves in 46 minutes. This is a somewhat faster rate than is usual in tournament play, but it was forced on us by the tight closing hours of the exhibition.

Doors opened for the players and exhibitors at 9:00 a.m., (10:00 a.m. for the public), and closed at 7:00 p.m. In order to get through two games a day, we had to limit each round to approximately 3½ hours.

Players were allowed a maximum of 30 minutes down time to rectify any program crashes, so the possible duration of each round was 4½ hours. Since the theoretical starting time for the morning

Figure 1. Draw and results, Round One.

Advance 2.4	½	Philidor	½
Spectrum Chess	0	Cyrus II	1
La Regence	1	Chess '86	0
Gambeit '82	0	President Turbo	1
Conchess	1	Mk. 5.01 Exp.	0
Micromurks	0	White Knight	1
Bogol	0	(Default)	

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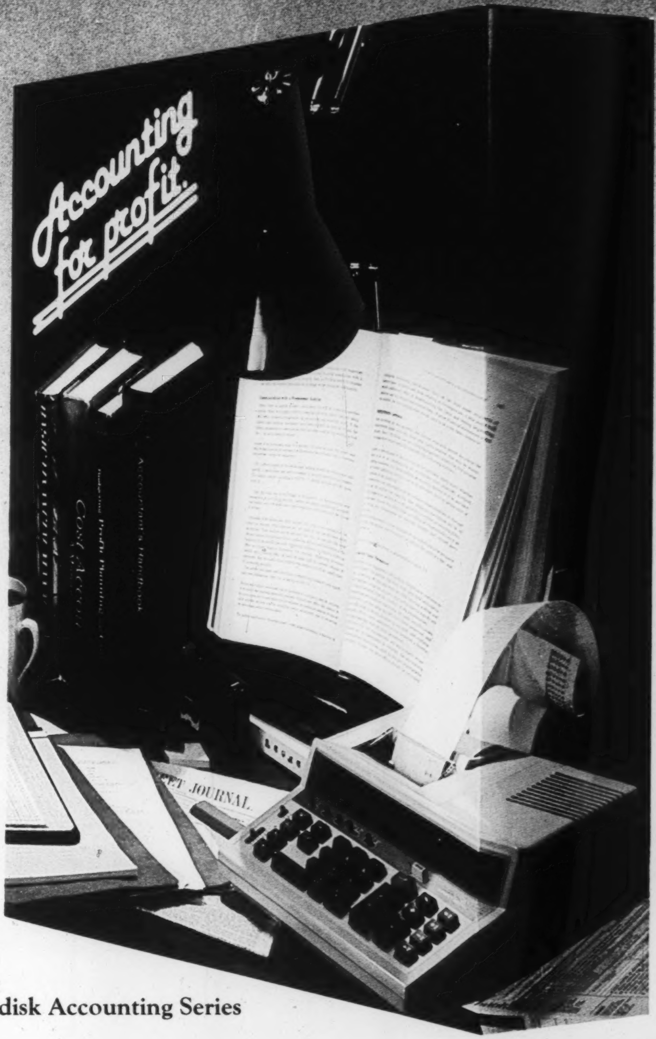

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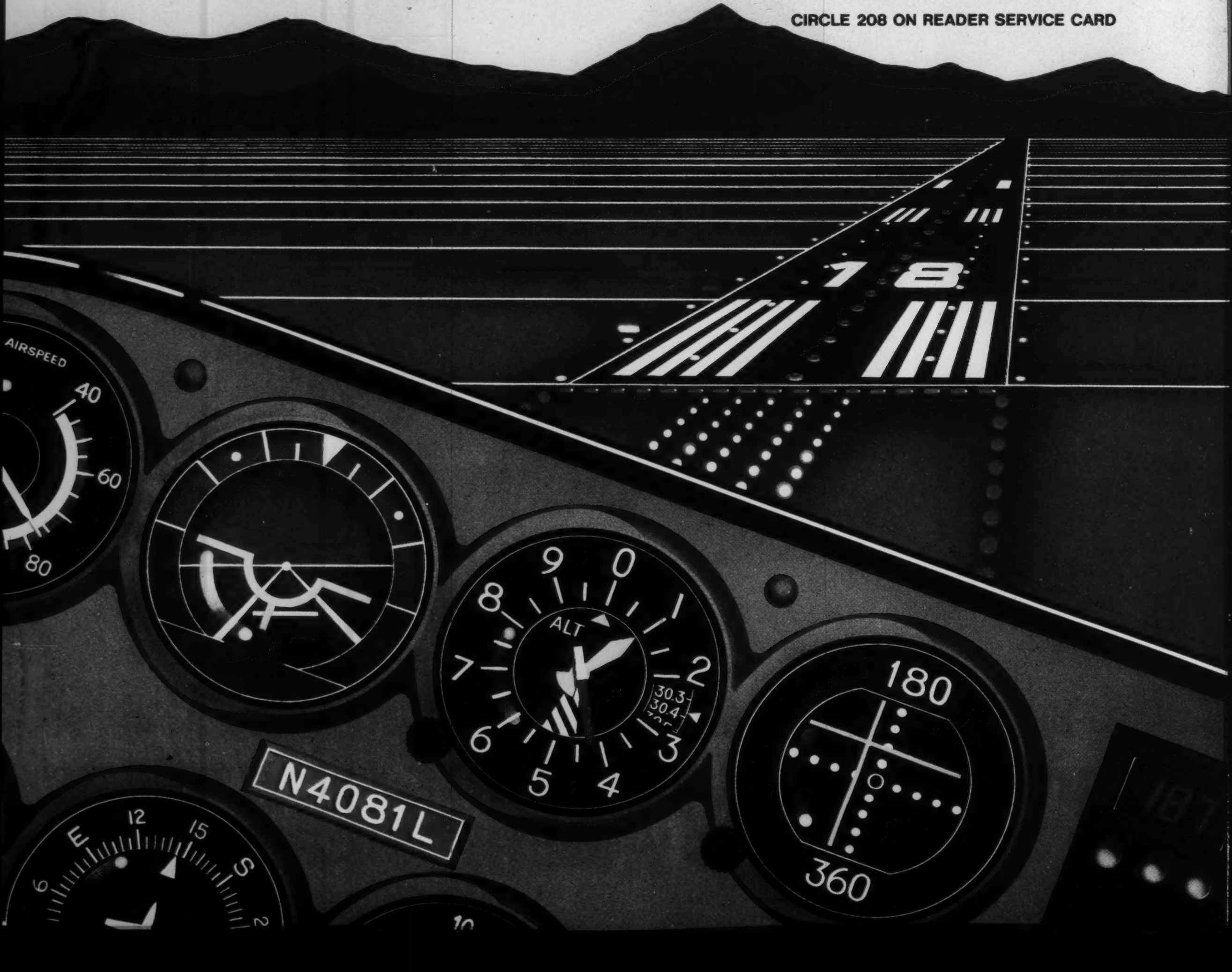

Figure 2. Draw and results, Round Two.

Cyrus II	(1)	½	Conchess	(1)	0
President Turbo	(1)	0	La Regence	(1)	1
White Knight	(1)	0	Advance 2.4	(½)	1
Philidor	(½)	0	Bogol	(0)	1
Mk 5.01 Exp.	(0)	½	Micromurks	(0)	½
Chess '86	(0)	0	Gambeit '82	(0)	1
A.N. Other	—	½	Spectrum Chess	(0)	½

Figure 3. Draw and results, Round Three.

La Regence	(2)	1	Cyrus II	(2)	0
Bogol	(1)	0	Advance 2.4	(1½)	1
Conchess	(1)	0	President Turbo	(1)	1
Gambeit '82	(1)	0	White Knight	(1)	1
Spectrum Chess	(½)	0	Mk. 5.01 Exp	(½)	1
Micromurks	(½)	0	Philidor	(½)	1

Figure 4. Draw and results, Round Four.

Advance 2.4	(2½)	1	La Regence	(3)	0
Cyrus II	(2)	1	President Turbo	(2)	0
White Knight	(2)	½	Mk 5.01 Exp	(1½)	½
Philidor	(1½)	1	Conchess	(1)	0
Bogol	(1)	1	Gambeit '82	(1)	0
Spectrum Chess	(½)	1	Micromurks	(½)	0

round was 10:00 a.m., and for the afternoon round, 2:30 p.m., a little mental arithmetic will tell you it was a close squeeze fitting both rounds in.

Because of the time pressure, it was decided to adjudicate all unfinished games at move 53. This set the tournament director, Stuart Reuben, some complicated adjudication problems in the course of the four days.

This first round was characterised by two events that looked more like absences than things that would shape the outcome of the tournament. Advance 2.4, running on a home constructed bit-slice machine found itself playing the white side of what must be one of the most boring Benoni defenses of all time.

Philidor, the opposing program constructed a blocked middle game in which the best either computer could think of doing was to shuffle rooks back and forth. The programmers read the papers while waiting for the inevitable draw by repetition. Fortunately Advance 2.4 went on to win the next five games in a row, in more aggressive fashion.

While this was going on, the Omikron team of Martin Suhl and Gerd Krey were busy missing the first round. Unfamiliar with London traffic, they'd made the mistake of taking a taxi from Oxford Street instead of a tube. Their program, Bogol went on to win four out of the remaining six games, and who knows, win in this opening round might have seen them draw level for top commercial entry with La Regence on 5 points.

The Second Round draw and results are shown in Figure 2.

Along with the 3rd Microcomputer Chess Tournament at the PCW Show, the Computer Scrabble Tournament proved popular with participants and spectators alike.

As the keen-eyed will have noted, the tournament had 13 entrants at this stage, though this was soon reduced to even figures for most of the tournament. Chess '86 collapsed during its game against Gambeit '82 and Jeff Cooper only managed to rectify it in time for the final round.

The day was exceptionally warm and the Barbican Centre was attracting record crowds. Computers don't like heat and several of them began to show their dislike. One of the SciSys entries, President Turbo overheated in a complex middle game against La Regence. It was a miracle that the President Turbo started the tournament at all, as Andrew Page, the SciSys UK general manager only received the module late the previous evening by airmail from Hong Kong.

Ideally, he would have liked a few weeks to test the program before the tournament, and we had to admire the competitive spirit that chose to enter rather than withdraw under such circumstances.

Later Rounds

Round Three draw and results are shown in Figure 3.

Richard Lang won last year's tournament and his program, Cyrus II had looked good up to this point. But La Regence proved too strong. Dieter Steinwender and the German team were becoming very disappointed with their program, which was showing definite flaws.

Round Four produced one of the key games of the competition.

La Regence put up a dour struggle against Advance 2.4, and the game went to the 53 move adjudication but Advance 2.4 was two clear connected passed pawns up in a rook ending and Stuart Reuben had no hesitation in awarding it a win.

Figure 5. Draw and results, Round Five.

Advance 2.4	(3½)	1	Cyrus II	(3)	0
La Regence	(3)	1	White Knight	(2½)	0
President Turbo	(2)	1	Philidor	(2½)	0
Mk 5.01 Exp	(2)	0	Bogol	(2)	1
Gambeit '82	(1)	1	Spectrum Chess	(½)	0
Micromurks	(½)	½	Conchess	(½)	½

Figure 6. Draw and results, Round Six.

President Turbo	(3)	0	Advance 2.4	(4½)	1
Bogol	(3)	0	La Regence	(4)	5
Cyrus II	(3)	0	Mk 5.01 Exp	(2)	1
Conchess	(1½)	1	White Knight	(2½)	0
Philidor	(2½)	1	Spectrum Chess	(1½)	0
Micromurks	(1)	1	Gambeit '82	(2)	0

Figure 7. Draw and results, Round Seven.

Mk 5.01 Exp	(3)	½	Advance 2.4	(5½)	½
La Regence	(5)	0	Philidor	(3½)	1
Bogol	(3)	1	President Turbo	(3)	0
Cyrus II	(3)	0	Micromurks	(2)	1
White Knight	(2½)	1	Spectrum Chess	(1½)	0
Gambeit '82	(2)	1	Conchess	(2½)	0

No one knew it at this stage, but Cyrus II had won its last game, beating President Turbo on adjudication. Reuben had his work cut out in this round, for White Knight and the Mk 5.01 also had to be adjudicated. This last was a very complex position, which either computer could have mishandled with ease. A draw seemed the fairest conclusion.

Round Five saw White Knight and Philidor falter and lose their way, though Mark Bryant with a final score of 3½ was still to finish strongly enough to take the second amateur placing and a cheque for £50, while Philidor, on 4½, would take third place overall in the tournament.

The game against Bogol was a stiff test for David Levy's La Regence in Round Six, and it was not without its commercial appeal as well as its chess interest, for both these sensory-board machines are due to be marketed before the end of this year.

After this loss, Martin Suhl was undecided whether he was pleased or displeased with the performance of his machine. No obvious flaws had been detected and its three wins were very reasonable chess games. In retrospect, the two losses Bogol suffered turned out to be to the machines which came first and second overall, and after picking up another point in the final round, the German team went home smiling.

Philidor had an easy game against Spectrum, but Richard Turner, of Arctic Computing thought that the ZX program had held its own well against computers that were very much more powerful. It was the only cassette tape module program in the competition and this is one area where one can expect a greater number of entries next year. Advance 2.4 by this stage looked unstoppable, and it duly crushed President Turbo with a fine mating attack.

The final round was full of surprises. The Mk 5.01 played a marvellous game against Advance 2.4, won material in the opening and looked set to force mate by move 26. But Advance 2.4 held on and although two rooks down, managed to find a position where it could force perpetual check with its queen — the human equivalent of a "swindle."

On board two meanwhile, the Intelligent Software entries finally came up against each other, and much to everyone's suprise, Philidor, which hadn't done much of note till then, chose that moment to play a complex, crafty game against the fancied La Regence and stopped its stable mate from winning 6 out of 7 games.

So although the final round had started with the faint possibility of a tie for first place between La Regence and Advance 2.4 (if the former won while the latter lost), the gods decided otherwise and gave us a clean, clear winner.

Mike Johnson and Dave Wilson took away just about every prize on offer. They won the trophy for the overall winner of the Third Microcomputer Chess Tournament, the trophy for the best amateur entry and a cheque for £150. La Regence was named as the best commercial entry in the tournament and Mark Bryant, as we said, collected a cheque for £50 for the second highest placed amateur entrant.

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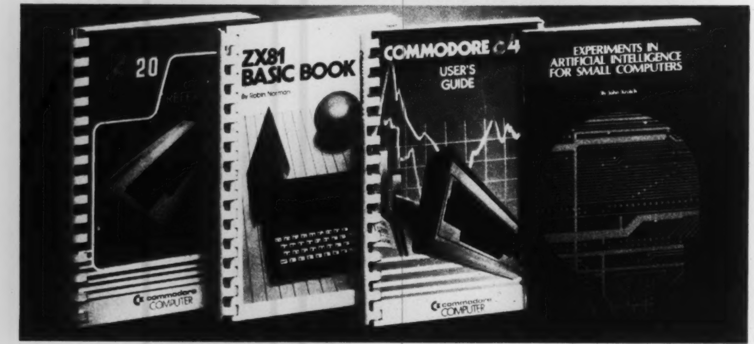
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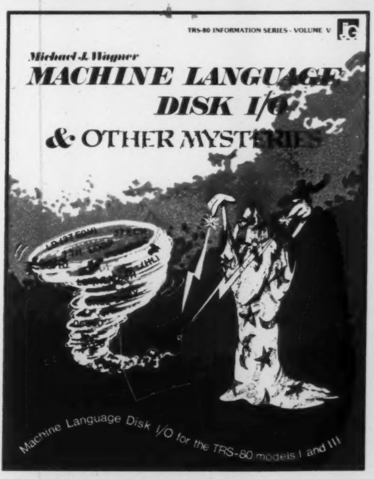

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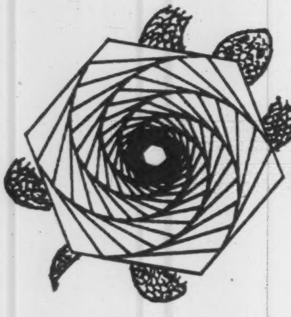

Logo Ideas

Robert Lawler

Microworlds And Learning

The central problem of humane education is how to instruct while respecting the self-constructive character of mind. Teachers face a terrible dilemma in motivating children to do schoolwork that is not intrinsically interesting. Either the child must be induced to undertake the work by promise of some reward or must be compelled to do the work under threat of punishment. In neither case does the child focus his attention on the material to be learned. The work is seen as a bad thing because either it is an obstacle blocking the way to a reward or it is the cause of the threatened punishment.

Psychologists know that much of learning is a gradual process, one of familiarization, of stumbling into puzzlements and resolving them by proposing simple hypotheses in which a new problem is seen as similar to others already understood, and of performing simple experiments to test the latest theory.

Microworlds can be seen as worlds designed for virtual, streamlined experiences, worlds with agents and processes one can get to know and understand. Properly designed microworlds embody a lucid representation of the major entities and relations of some domain of experience — geometry and music are two examples — as understood by experts in the domains. This is where the knowledge of the culture is made available in the very terms in which the microworld is defined.

The child's appropriation of that knowledge is made possible by the microworld not being focussed on problems to be done, but on "neat phenomena" — i.e., the primary manifestation of the power made available by knowledge about the domain. If there are neat phenomena, then the challenge to the knowledgeable expert is to formulate so crisp a presentation of the elements of the domain that even a child can grasp its essence. The value of the computer is in building the simplest model which an expert can imagine as an acceptable entry point to his own richer knowledge.

If there are no neat phenomena that a child can appreciate, there is no function that knowledge of the domain can serve for him. He should not be expected to learn about it until he is personally engaged with other tasks which will make the specific knowledge tolerable as a supporting prerequisite to something desirable to know.

Robert Lawler, Centre Mondial Informatique Et Resources Humaines, Paris, France.

The Idea Of A Formalism

A formalism is a set of symbolic objects that are related by the operations or manipulations that can be performed on them. Everyday arithmetic is an example of a formalism: the numbers are related to one another by addition, subtraction and so forth. We often use formalisms, such as arithmetic, without asking what there is about them that really makes them useful in thinking.

The mathematician-philosopher Whitehead raised this question about the calculus, another formalism, and proposed an answer of the following sort: A formalism is useful because it gives you one less thing to worry about. You learn a set of rules of almost mechanical manipulation, then you can concentrate on how to apply them to a specific situation about which you want to know more. You judge the applicability of a mathematical formalism by whether or not its predictions correspond to what happens in the problem domain.

A programming language such as Logo is also a formalism — but one whose focus is more on its concrete use than on its symbolic prediction. In this sense, the Logo language is a kind of empirical mathematics, one whose value does not depend upon immediately mastering perfectly a set of rules. One can begin with a faulty procedure and perfect it by debugging — retrying the execution until it produces the intended result or a better one is discovered along the way. Eventually, one may become sufficiently expert to compose perfect code, but it is not necessary that one ever do so.

A relaxed requirement for perfection is one major way that Logo programming contrasts with the child's other experienced formalism, arithmetic. This is important because in the world of turtle geometry, the domain of design is so rich that unintended results can often be more attractive than what the programmer first intended. This is a direct contrast with arithmetic — in which errors are of positive value only to psychologists. There is a second sense, however, in which Logo programming requires perfection as much as any other formalism. When one is committed to a specific result, specific operations must be performed in the correct order to achieve that result. Because of the relative richness of the error paths in turtle geometry, Logo may be a more accessible formalism — and a more attractive one — than children commonly met before the advent of computers. □

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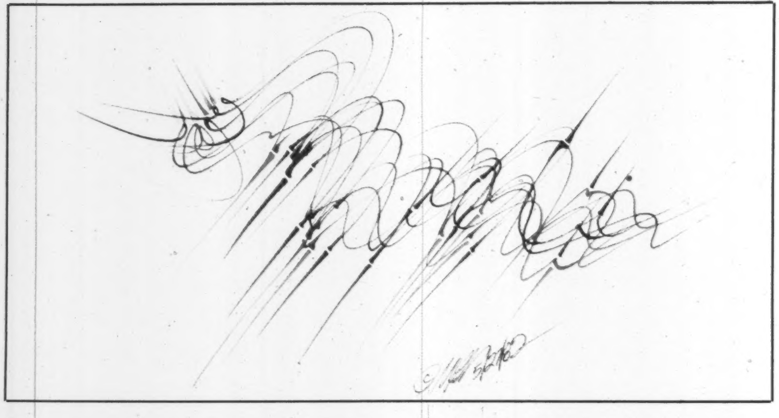
When is Computer Art Art?



Robert E. Mueller

Art is a tricky subject. Everyone recognizes various kinds of objects they call art. Concentrating on the visual arts, what art is to most people usually limits itself to framed pictures hanging on walls. Obviously this may cover a very wide range of pictorial images, from pictures of flowers and landscapes, to abstract images and colorful designs.

The criterion for art most people apply is that a picture must be pleasing to them, and that it must be, at most, complex to the point that it does not quickly vanish in boredom. This means that when a person catches a picture in his eye, it should at least fascinate. But is it art?

Everyone realizes that there is a vast corpus of objects which some people call "art" that differs from what *they* call art. What is the difference — is it just a matter of snobbery? Are the serious art lovers, who embrace a dizzy succession of objects that sometimes seem to verge on the ridiculous, fooling themselves? To put it bluntly: is modern art and the avant-garde you read about skeptically, full of baloney?

To begin with, many art critics feel that there is no longer an authentic avant-garde. Take for example Hilton Kramer, who recently retired as critic for that most prestigious culture-setter, *The New York Times*. Kramer suggested in his swan song that our eager appetite for innovation, our readiness to accept the arcane, the outrageous and the unfamiliar, has killed the very idea of an avant-garde. Regardless how shocking or banal the art form, powerful galleries, museums and collectors instantly embrace anything that comes along, competing for the honor of discovering something *new* in art. And to make matters worse, government agencies, businesses, and private foundations stand ready to back them with as much money as they need.

Critics and concerned artists have been watching the march of art fashions over the past 50 years with horror. Realism disappeared, expressionism came into being, cubism was born, abstractionism emerged, non-objective art splashed forth, followed by a stream of fads and fancies including Pop Art, minimalism, and field painting, only to return recently to realism.

We must conclude that anything goes in modern art, because the norm seems to be that there is no norm. And if the major critics or aestheticians are confused, what about the rest of us? We must ask ourselves the same question Aristotle, Tolstoy, Kant, Susanne Langer asked: What, after all, is art?

Back in 1976 I wrote a little article published in *Art in America,* and reprinted in *Creative Computing* (May/June 1978), that attempted to apply my years of training as a visual artist to the efforts of computer specialists who dabble in pictorial graphics. I took a look at the images which computer people were creating back then, from the standpoint of an art specialist, and tried to come to some critical conclusions which might help future "computer artists" in their efforts.

Since then I have read many critiques of computer graphics; seen many shows; studied many books on the subject. I have discovered very little to change my views on the subject — which means either that I am stagnant, or that my critique still holds up. (See box.)

If It Is Visual Must It Be Art?

In general, most theorizing about computer graphics as art is upbeat and reassuring. Seldom is a question ever raised about the validity of computer art as art. The assumption is that since it is visual, it must perforce be art. This viewpoint is not only naive, it is sloppy thinking.

The word *art* is taken in its first level dictionary definition as a "skill acquired by experience, study or observation." This definition neglects the conscious use of the creative human imagination for the fabrication of valuable, human aesthetic objects, and never thinks of art as being something with a long history and tradition.

Those with some knowledge of art history frequently put on blinders, rationalizing that their attitude will permit a fresh start in a confused, stagnant field — which admittedly it is. But there is no use reinventing the wheel.

I wish to suggest that traditional art training has something to teach us as computer artists. My reasons are probably selfish: I am a visual artist with a vested interest in many tired old media. I

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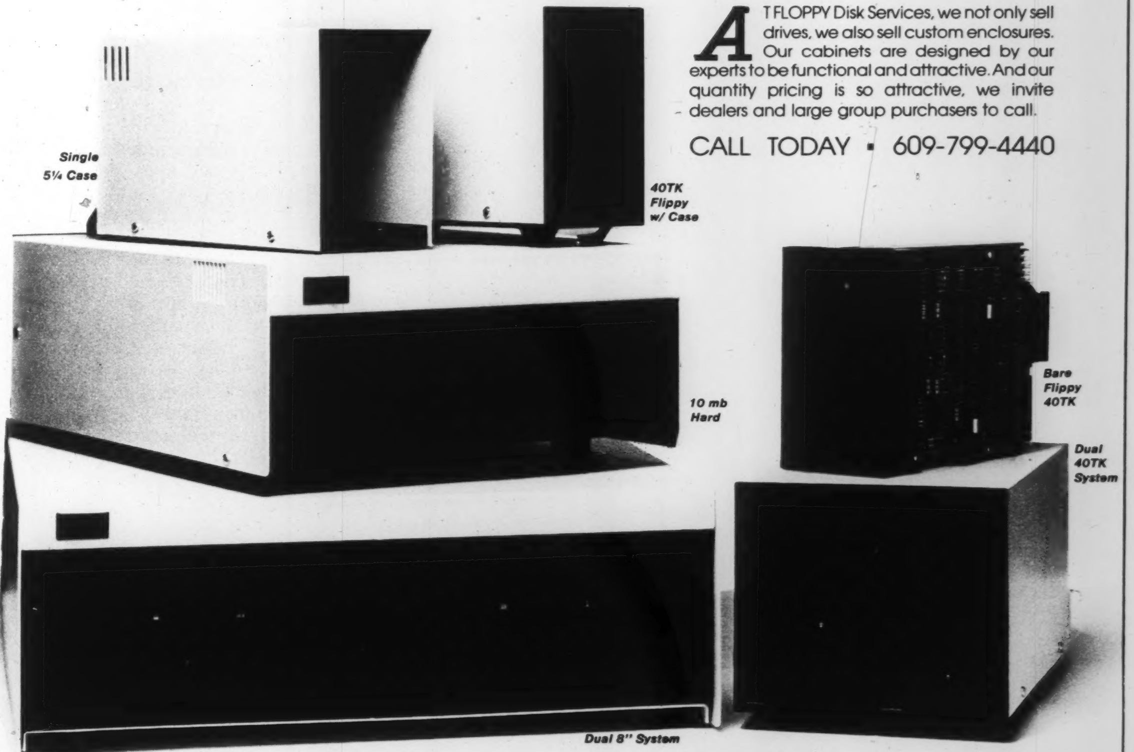

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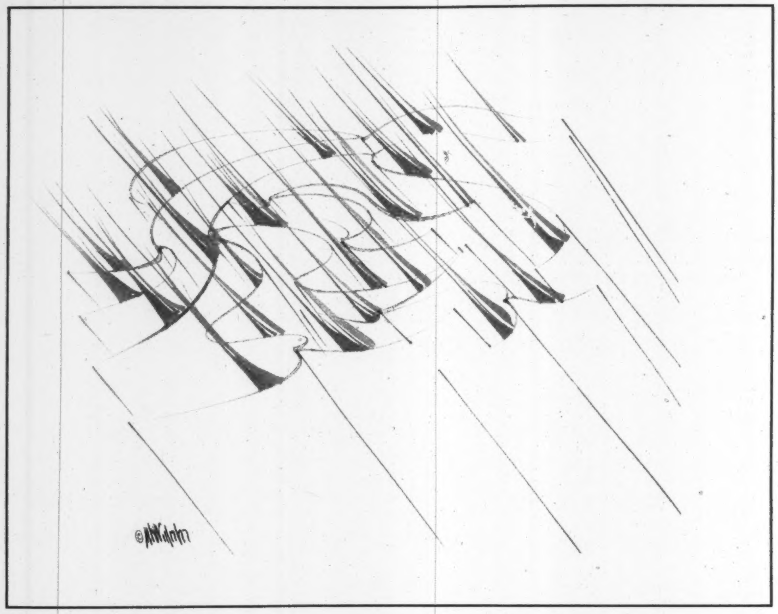
paint in oils (abstract and expressionistic), do traditional woodcuts and drawings, and sculpt occasionally in wood and clay. But I have also theorized about electric media for many years. See my article entitled "Electric Media," in an early issue of *Creative Computing*, and my book *The Science of Art: The Cybernetics of Creative Communication*, (Day, NYC, 1967).



I have been trying to apply my M.I.T. science background, and N.Y.U. aesthetics/philosophy training to the problem. My conclusions have been hopeful, but the practice I observe is discouraging: Where is there an art using the computer and video media that even vaguely transcends its inherent mathematico-lissajou-feedback design qualities? Or where is one that *uses* it, and succeeds in fascinating me?

Perhaps I am too enmeshed in the old media. But there are, after all, art schools. People spend many years studying art, learning about art, trying to discover the techniques of picture making. The chances are that these people are not all kidding themselves. Out of the many academies of art must have come some expertise in the creation of visual images.

It may be true that this expertise is supplanted from time to time when another aesthetic comes along. This is what makes art evolve like an organic thing. But by and large, certain "rules" have emerged that seem to apply consistently to (most) art forms. I hedge because there are no absolutes in art (no more than in science, although admittedly less definitely so) — which is why people seem to be justified in saying that anything goes in art. The feeling is that art judgment reduces to what you like and don't like. But this is far from the truth.

Fascinating The Critics

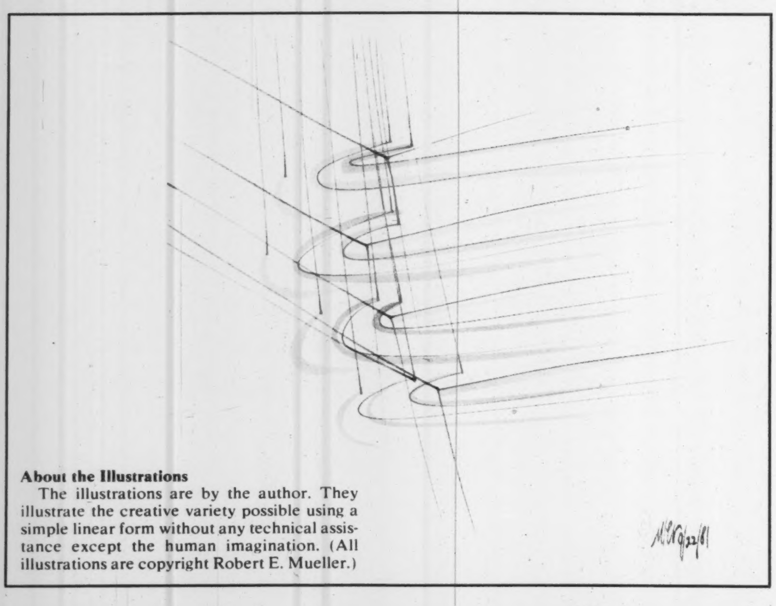
I do not believe that this non-criterion for creating interesting visual images takes you very far in the direction of originality. Let us then agree, at least partially, that we would like our computer art to be original to the extent that it would fascinate a critic like Hilton Kramer. Assume, that is, that we must make images at least as good as — as interesting as — the best in art which currently abounds in the non-computer world. How do we accomplish this? My answer is that we must apply the same criteria to computer products practicing artists use in their craft, regardless the medium.

We must be, first and foremost, critical. We must not accept something which the eye in its naivete thinks is fun, exciting, bizarre, beautiful. The eye, we all know, can be fooled very easily — witness optical illusions. Is this art?

Also the *mind* can be fooled easily — particularly when it comes to what is called "beautiful" in this world. People, especially children and young people, lovely women, and sometimes men, are beautiful; sunsets are beautiful; flowers, nature, landscapes, seascapes and clouds are beautiful. Are images of them all automatically artistic?

We suffer from what the philosopher William Barret calls "the illusion of technique." It is easy to get carried away with technique because it can be so much fun, and so automatic. Especially if you have a powerful technical device like a computer or a holographic camera or a dye-laser to play with. These machines in and of themselves, entirely automatically, have an autonomous quality which, when made visually, causes great wonder.

We must therefore be highly critical of what we call art when it comes out of a computer, particularly if we advertise it as "fine art." Otherwise the cultured world with knowledge of art will think, and rightly so, that we are kidding ourselves.



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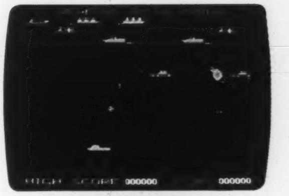

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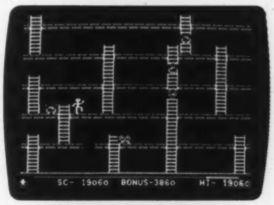

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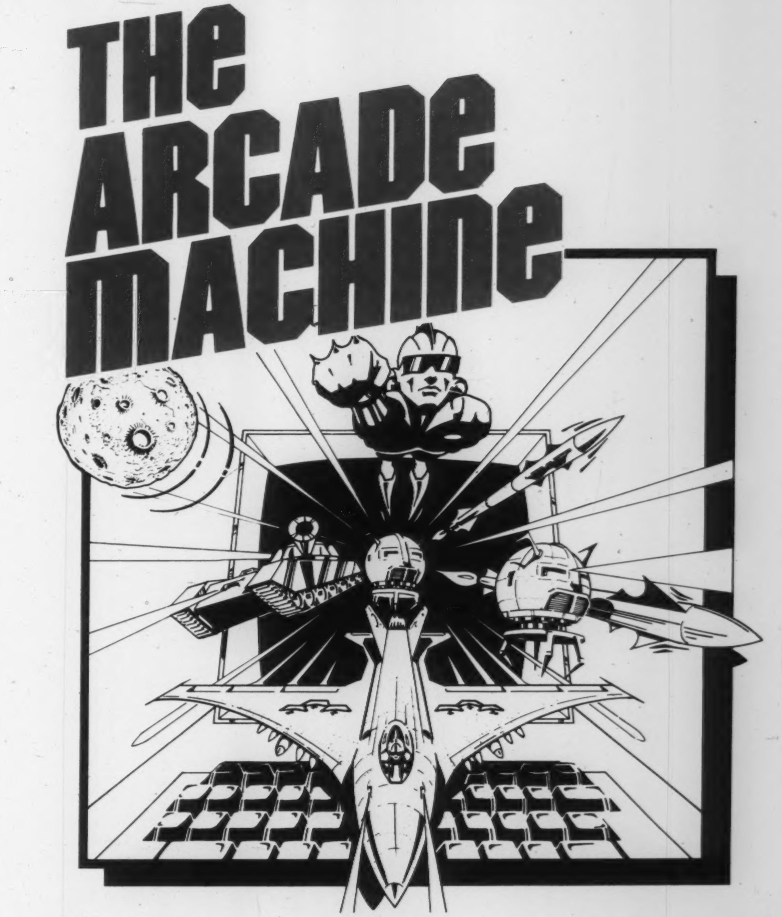

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Computer Art, continued...

Idols Of Computer Art

In 1622 Francis Bacon wrote his *Novum Organum,* in which he suggested a broad approach to the scientific method that has influenced all scientists since then. Perhaps the most valuable aids he proposed were warnings about the idols or false appearances of the mind.

We know them as Idols of the Tribe, which describes how we are prone to suppose in nature a greater order and regularity than exists there; Idols of the Cave, in which we project errors unique to each of our personalities upon nature; Idols of the Market Place, in which errors arise because of the influence of words; and Idols of the Theater, in which fallacious thinking results from bad methods of philosophical demonstration.

I propose the following Idols in the same spirit as Bacon's, not as impossible ways to make art, but rather as pitfalls that easily fool a person into thinking art has been created.

Idols	Fallacy
Idol Of Nature	Supposing that direct translations of natural forms into recognizable images makes art.
Idol Of The Formula	Taking the inherent orders of mathematical equations and turning them into images.
Idols Of The Kaleidoscope	Being fooled by the artistic look of images made from arbitrarily unleashing the combinatorial graphic powers of computers.
Idols Of The Game	Chasing orders or trapping quotas of chaos to accumulate what seem like artistic images.
Idols Of Disguise	Camouflaging or repackaging images by making transformations in the alembics of design.
Idols Of The Eye	Tricking the eye into thinking that, color illusions or optical novelties are artistics.

I am sorry to say that a program like *Nova* showing computer specialists turning out what they think is serious art, can appear ridiculous to a practicing artist — at least it did to me. The same applies to much computer music — it makes good background music for movies like *Star Wars,* with added visuals made up of the video feedback or lissajou variations, but that's about as far as it goes for the trained artistic observer. You tend to forget it easily, and have absolutely no desire to hear it again.

Constructive Criticism

Don't get me wrong. I think that the computer and all other electronic transducers are important for art. In fact, it is *because* I think that serious, fine art and music can be created using computer techniques, that I am so critical. It is a shame that so many productions fall so short of the media they try to imitate or transcend.

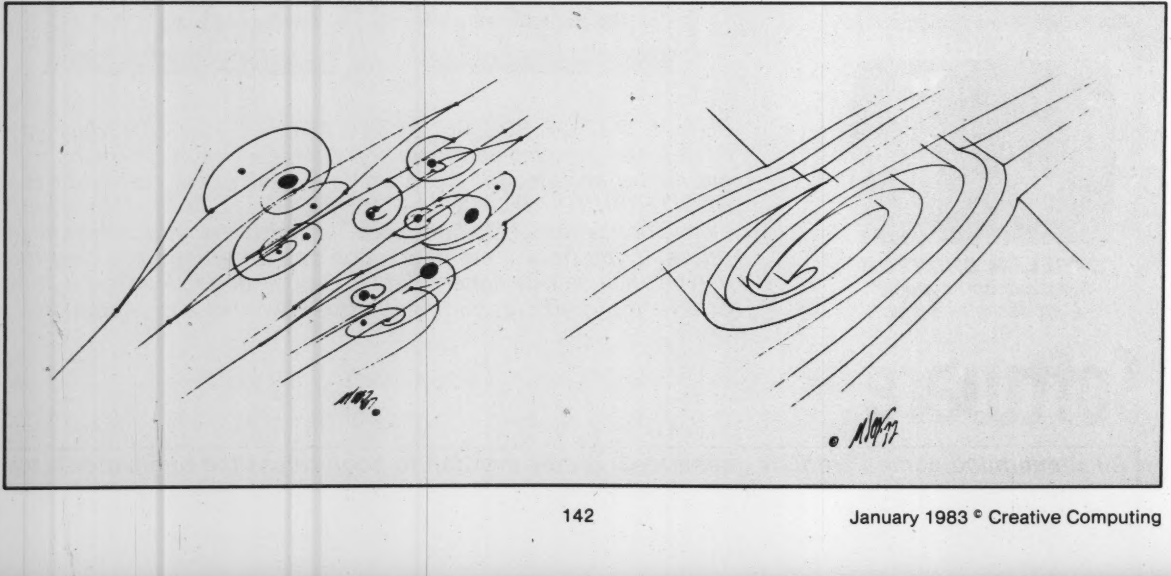
My optimism about the future of computerizing art is the reason for this article. I hope to snag a mind here and there, and convince them to read Rudolph Arnheim *(Art and Visual Perception),* Ernst Gombrich *(Art and Illusion or The Sense of Order),* R. G. Collingwood *(Principles of Art),* or Susanne Langer *(Feeling and Form).*

There is much more to art than the fun of putting together images and being amazed at the serendipitous results displayed on a color monitor.

Art is more than twists and turns of simple, kaleidoscopic digitized harmonies. Restrict yourself to the technique and you restrict your potential. We are more than our techniques; the ghosts in the machines are what count — all the more so when we try to computerize them.

It is extremely easy for almost anyone to make computers do fun visual things. I have said elsewhere that the computer is like a kaleidoscope. Add color to the equation and you can really go bananas with eye-appealing dazzlings. If you apply some of the more powerful graphic abilities of large computers, you can do some far-out visual things. The recent Walt Disney movie *Tron* proved that computer graphics — especially unleashed in time — can be a successful visual accompaniment to a dramatic plot. To stand alone like music without an opera, however, is another matter.

Many groups are working to create wonderful tools and fabulous techniques for making images. Scientists at the New York Institute of Technology, for exam-



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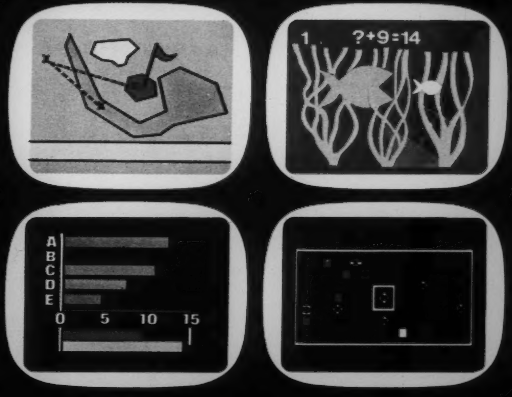
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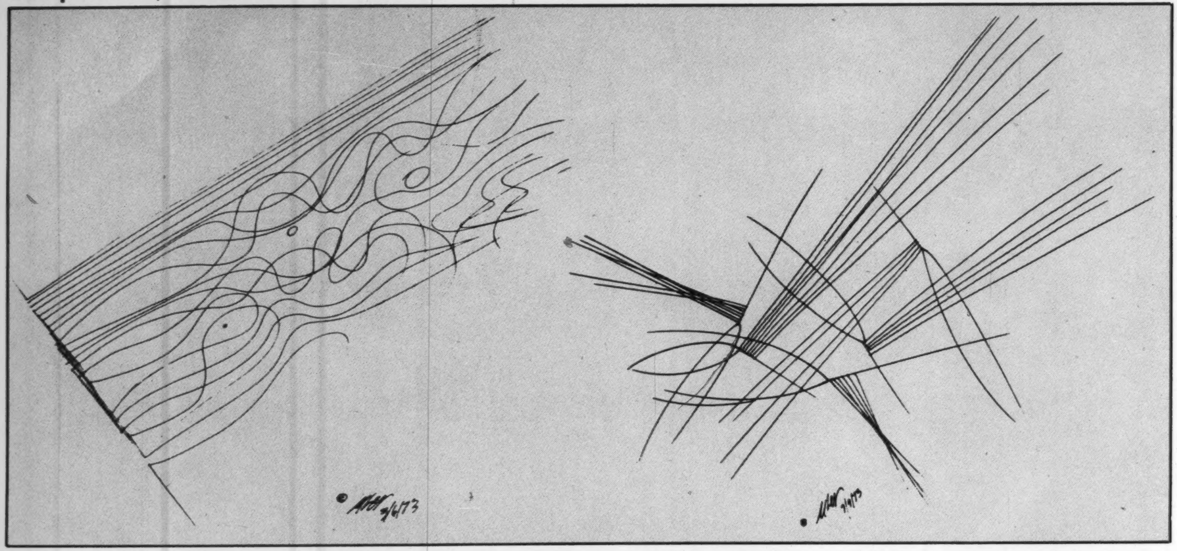


ple, are at the forefront, taking out many patents on devices for improving our techniques for creating graphics and animation to control the color and contours of characters and scenes unendingly. I have a patent on a video graphic system myself.

The more the merrier — make them available to everyone. Color video pallets are the next thing we are going to see marching into our living rooms or capturing our hand-held calculators and other chip-emblazoned gadgets.

In general all of these devices are quite interesting, at least technically, even to an artist. But will they in themselves enable us to create valid, fine art? Since even the experts seem to be confused about what is or is not art, you might argue that they ought to be included in this most ambiguous category of human production.

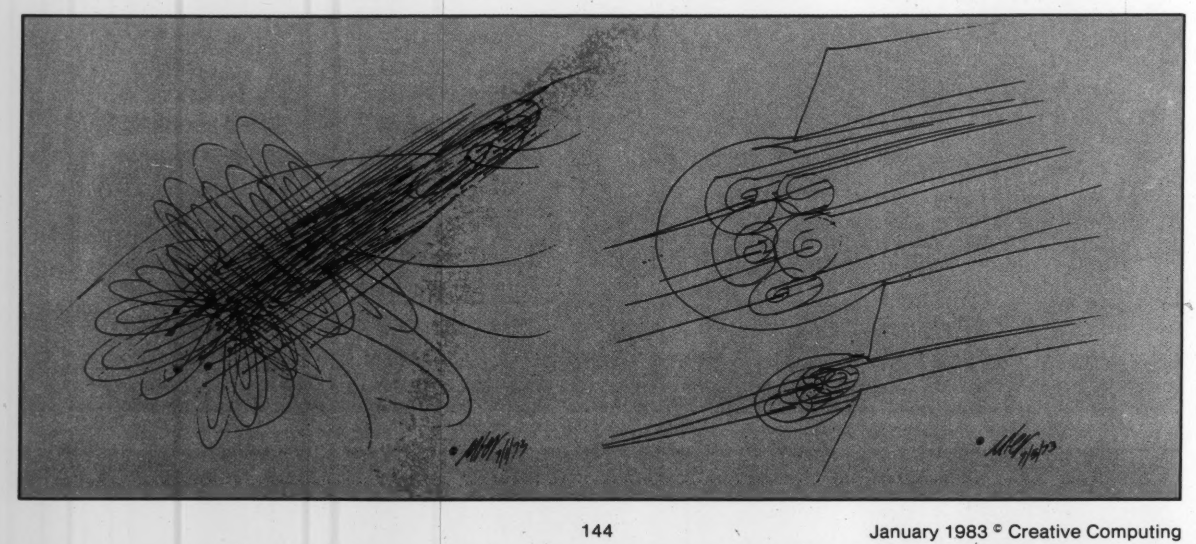
I am not saying that computer graphics, when produced by extremely sophisticated software, is not art. I am saying, however, that most of it appears very boring to an eye trained to recognize interesting visual images.

I am further arguing that we should exert caution when calling computer graphics "art." There is a vast world of simple reproduction or pure design which, is not art — although very interesting and original.

Realism is not enough. And design, unlike art, hinges on creating orders within orders; regularities that breed symmetries; proportions that are elegant and derived from magic squares, the perfect mean, and other natural progressions.

I am making a plea for anyone truly interested in turning computer graphics into a more serious art form, to study art history and theory, to go back to the simpler art forms and learn what makes them artistic. Why is a line drawing, made with a pencil, the most elemental of human media, capable of becoming art? This question is not easily answered, but in my opinion it requires considerable study and exposure to great works of art.

We cannot let ourselves be carried away with dazzling new scientific techniques, believing that they are automatically art just because they overwhelm our untrained artistic eyes. We must look at Leonardo before we can consider ourselves Leonardos. ☐



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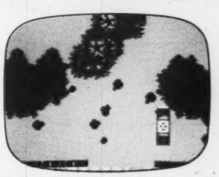

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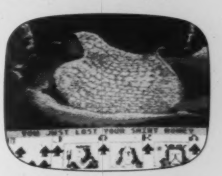

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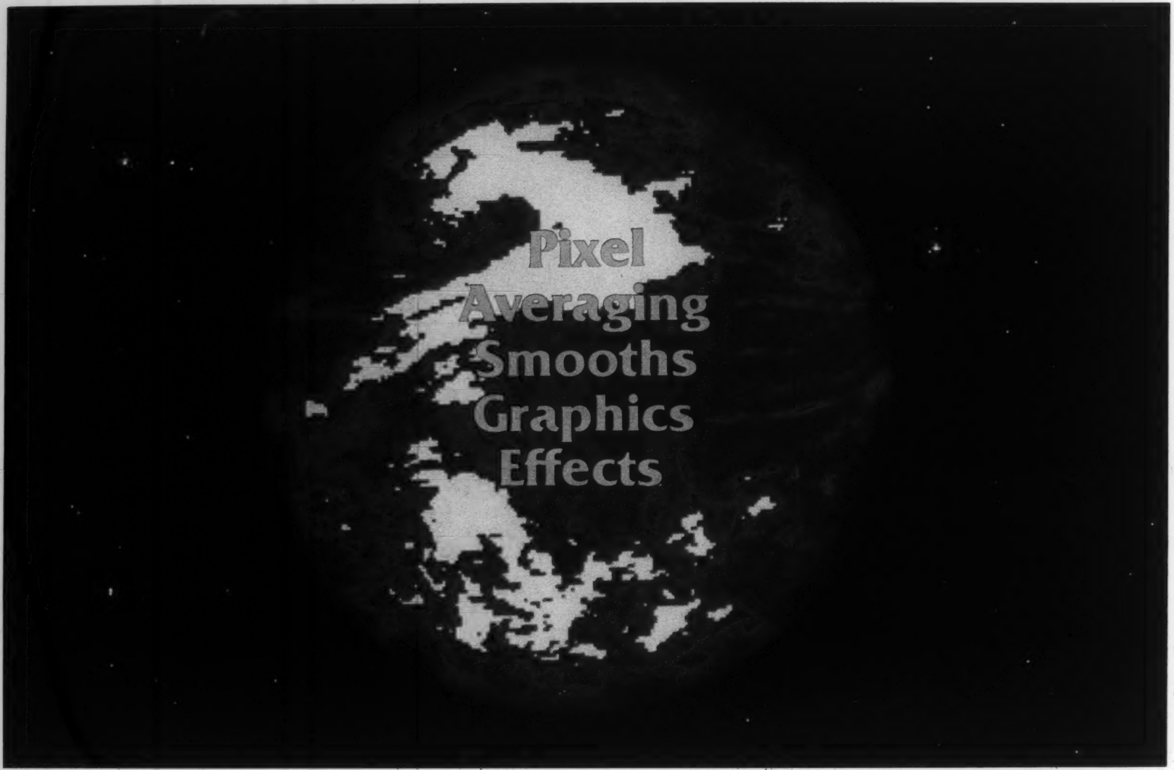

Figure 8. This photo was created by taking various computed images, and manipulating them with Replace, Xor, Or, Subtract, Add and And averaging until they created the earth (notice the thin atmosphere surrounding the earth done with Replace and Add averaging). This became exposure one. The second exposure consisted of the stars which have no averaging. This is a good example of the results obtainable by combining all forms of averaging.

Pixel Averaging Smooths Graphics Effects

David Cook

Have you ever looked at NASA's computer enhanced space photographs or any of the computer graphic effects on television and said to yourself, "Someday, I'll own a system with that much resolution"? Have you ever wondered how they achieve such smooth graphic effects?

Chances are, if you already own a computer capable of color or black and white shaded graphics, you can produce smooth graphics and effects without high-resolution and at relatively low cost.

Background

Digital Image Corporation of Grand Rapids, MI was founded in 1981 to create computer graphics and a computer graphics system for advertising, slide shows, TV, and other media presentations. One of our goals has been to design a system which produces very clean, low cost graphics.

Note: All photos were created by David Cook except the two marked with an asterisk (*) which were created by Bill Romanowski.

David Cook, Digital Image Corporation, Grand Rapids, MI 49503.

One of the problems we encountered has been resolution. For example, 35mm slide film has a resolution of about 4000 lines, while few inexpensive computers offer more than 512 lines. A second problem is the fact that 35mm slides are usually projected onto a large screen, increasing the resolution problem.

At Digital Image, we have designed software which produces very clean, full color graphics without matching the 4000 line film resolution requirement. This article attempts to explain just one of the many methods we employ to achieve even graphics.

The ideas presented here should give you a good start. Some of our techniques are not new. However, the ways in which we use some of them are completely new and have provided a great deal of insight into the secrets of computer graphics.

Our computer system includes: a Cromemco Z-2D System Two (Z80 CPU, 64K); Two 5" floppy disks (386K each); Cromemco SDI graphics board; Two 48K image memory planes; a Houston Instruments bitpad; a Via Video digitizer; an Aydin Controls RGB monitor (Mitsubishi in disguise); and a matrix camera (produces 35mm slide from RGB signal from computer).

Resolution in the system is 378 x 241 in lo-res mode (16 colors out of 4096) and 756 x 482 in hi-res mode (two colors out of 4096).

The Basic Algorithm

Though everyone reading this article who currently owns a computer with graphics capabilities will benefit from these techniques, the basic algorithm is geared to computers with a color or

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Creative
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Figure 1. This photo was made by taking the word CREATIVE COMPUTING, and Replace averaging it to the alternate page. After each average, all colors are converted to 15 (the brightest) and the result is again averaged. This is done in order to make the glow appear larger then the actual wording. After the desired glow size is obtained, the words CREATIVE COMPUTING were copied over the glow and then Xor copied, leaving the inside black. Then the outline of the word was copied into the glow using color 15 which was converted to orange while the glow was shaded between black and red.

Figure 2. This photo was made by taking the word GLOW and Replace averaging it to the alternate page until the desired glow was obtained; this became the first exposure (in cyan). The second and third exposures were obtained by taking a sphere, inverting it (via Xor) and fuzzing it until the desired glow was obtained. These were then shot in red and green respectively.

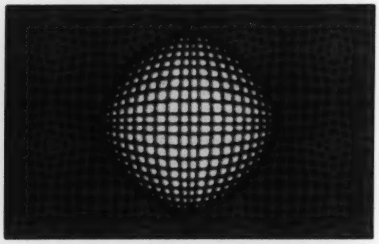

Figure 3. This photo was made by taking a sphere, inverting it, Replace averaging it, and shading it between black and yellow. This became exposure one. The second exposure was created by taking the inside of the sphere and keying it onto the rest of the frame on color zero (background) which has the effect of placing the image behind *the center sphere. This image was then shaded from black to red and then from red to blue and shot. Notice the outside edge of the center sphere is not smooth. This is because the outside edge does not sit next to a complementary color, thus jagged edges show up.*

black-to-white shaded map display, such as Atari, Cromemco, and Cromatics. The basic algorithm, and the one from which all other techniques described in this article are derived is called *pixel averaging*.

In pixel averaging for any given pixel on the screen, an average can be calculated by adding the values of all neighboring pixels and then dividing by the number of neighbors and plotting the result. For example, below we see a pixel (center pixel with a color map value of 2 surrounded by pixels of different map values:

3 4 15
7 2 10 (2 is the center pixel)
1 9 5

In calculating the average of the center pixel:

$$P' = (P1 + P2 + P3 + P4 + P5 + P6 + P7 + P8)/8$$

or

$$P' = (3 + 4 + 15 + 7 + 10 + 1 + 9 + 5)/8$$

or

$P' = 6$ (drop the fraction)

To apply this algorithm correctly, scan the area containing the image and apply the algorithm to each pixel within that area. The result from each calculation may be immediately plotted back onto the display over the original pixel. However, much cleaner results are obtained if the averaged information is plotted somewhere other than on top of the original image—another image plane, disk, core, or even somewhere else on the same image plane.

If the results are plotted over the original, you will obtain a similar result, with a slowly accumulating degree of error. The error occurs because the pixel you just changed is a neighbor to pixels you are about to change. If you plot the new pixel on top of the old pixel, you will be changing future results for the neighboring pixels. (Later on however, I will explain how plotting the new pixel over the old one can be useful.)

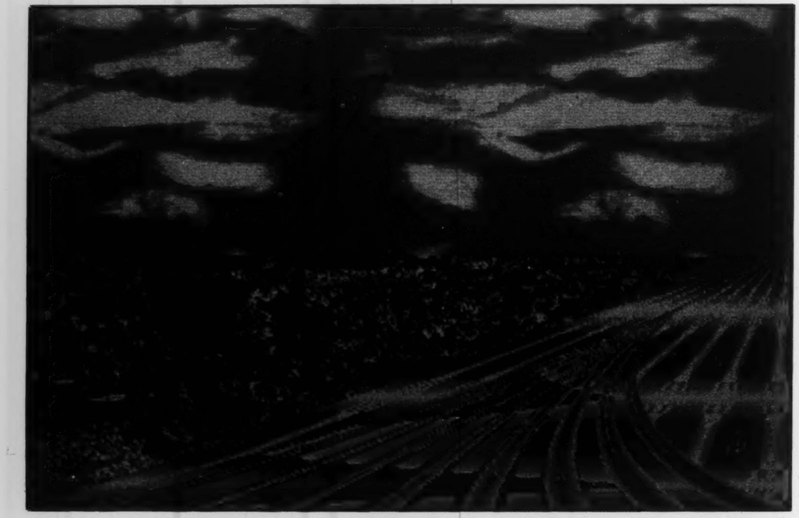

**Figure 5. This photo was created by taking a straight two-dimensional grid, tilting it in the horizontal direction with a skew added (this makes it disappear to a horizon) and then tilting it in the vertical direction (this made the grid curve). The grid was then Replace fuzzed and shot as exposure one, the road. The next exposure was created by digitizing pieces of tissue paper and REPLACE fuzzing them to add softness. These became the clouds. The final exposure was created by taking the same tissue paper used for the clouds and repeatedly Or fuzzing it to create the rock and roadside images.*

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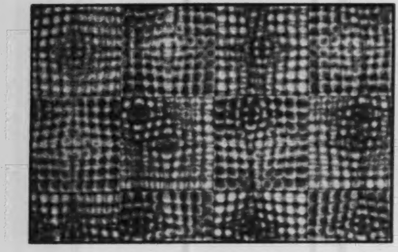

Figure 4. This photo was created by taking three different versions of the background created in Figure 3 and shooting the first shaded between black and red, the second shaded between black and green, and the third shaded between black and blue. This causes much color interference on film which shows up as beautiful hues. All of the exposures were Replace fuzzed to enhance the interference.

Once an image has been averaged, the color map must be adjusted to provide the smoothest display possible. This is probably the most important and difficult (depending on your hardware) step in pixel averaging.

To explain how to arrange the color map, let me describe the way it is done on our system and then offer examples to make it work on other systems.

On the Cromemco, in low resolution mode (378 x 241) up to 16 colors out of a possible 4096 may exist on the screen at the same time. The colors are numbered 0-15, the actual numbers written when a pixel is placed on the screen, and thus the actual numbers being averaged.

Each color number (0-15) on the Cromemco may be assigned a red, green and blue gun value between 0 and 15. This allows any color (0-15) to be any one of the 4096 colors available (16 x 16 x 16). The map must be arranged so that the lower the color number, the darker the color. Therefore, if I want my image to glow a smooth blue, I shade my color map as shown in Table 1.

Table 1.

Pixel Value	Red Gun Value	Green Gun Value	Blue Gun Value
0	0	0	0 — Black
1	0	0	1 — Darkest blue
2	0	0	2
3	0	0	3
4	0	0	4
5	0	0	5
6	0	0	6
7	0	0	7
8	0	0	8 — Medium blue
9	0	0	9
10	0	0	10
11	0	0	11
12	0	0	12
13	0	0	13
14	0	0	14
15	0	0	15 — Full blue

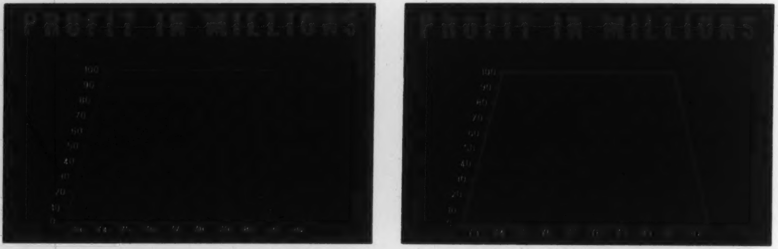

Figure 6. This photo was created by taking a two dimensional bar chart, Replace averaging it to the alternate page and tilting it to a horizon. The second and third exposure are composed of the word copy (the first in green, the second in white) and are done in high resolution (756 x 482 x 1 color). Figure 7 is Figure 6 without any averaging to show how averaging smoothed out the jaggies.

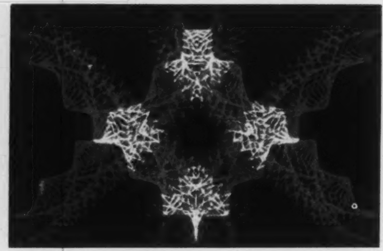

Figure 10. This photo is an example of our Odd language in action. The first two exposures were the red and green rotating and flipping stars. The last exposure was the center blue star which was Replace averaged.

In effect what averaging together with proper color map manipulation does, is take a particular neighborhood and modify the color of the center pixel to make it "more like" its neighbors. If half of the neighbors of a center pixel are zeros (0) and half are fifteens (15), the center pixel will become a seven (7).

As the neighborhood moves through the area containing the image, each of the center pixels becomes more like the neighbors. (Remember, all neighbors get a chance to become center pixels.) This has the effect of fuzzing the image, or making it glow. Therefore, if the map is shaded from dark to light, the image will appear smooth.

This method should work on machines such as the Atari, but users of machines with fixed color maps such as the Apple and TRS-80 will find it more difficult to obtain smooth images. For these machines, assign a lookup table of colors arranged so the darkest color value is first and the brightest color last. When you read a pixel from the screen, average the index to the color in the table, not

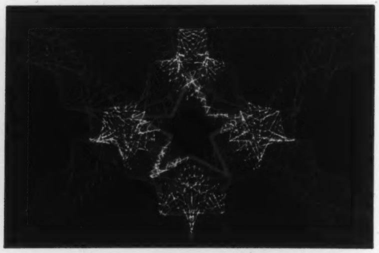

Figure 11. This photo is identical to Figure 10 except that all *components were Replace averaged.*

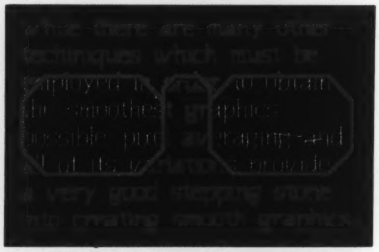

Figure 9. This is a fun photo, and a good commercial effect. (Note that the text is from the article.) The photo was created by taking the text and Replace fuzzing only words existing outside of the glasses. This became exposure one in low resolution, shaded between black and red. The second exposure was the text existing inside the glasses which was shot white in high resolution. The third exposure was the glasses which were shot cyan in high resolution.

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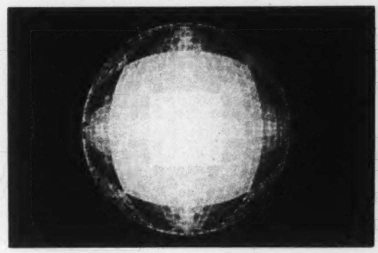


Figure 12. This photo was created by taking a high-resolution sphere (the same one used to make the Earth slide) and manipulating it using Subtract, Replace, Or and And averaging until a somewhat smooth image resulted. Replace averaging is responsible for the three-dimensional look.

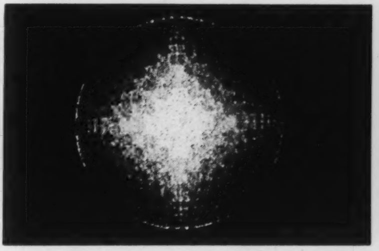


Figure 13. This photo is similar to Figure 12 in that the basic image was created in much the same way. However, the shading and three-dimensional look were added by many repeated Replace averages.

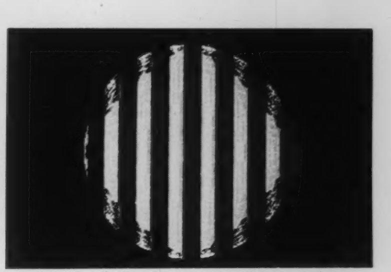


Figure 14. This photo is similar to Figures 12 and 13 in that the basic image was created from a high-resolution sphere. After the initial shape was created, it was And Copied onto bars which had been Or averaged to produce the effect of light shining from an angle. The bars were then And Copied onto another image which placed the dark and light shapes onto the bars. The result was then Replace Copy Averaged onto Replace averaged bars to give the edges a very smooth and three-dimensional look.

the actual color value. When writing the new pixel out, write the color *at the index* in the array corresponding to the result from the calculation. This method will pseudo-shade on fixed map machines. To understand this method better, try the following example:

Let us imagine that your computer only has the following eight colors:

0 = Black
1 = White
2 = Light blue
3 = Red
4 = Dark blue
5 = Yellow
6 = Dark green
7 = Dark purple

You would create an array, arranging the colors from darkest to lightest (you may have to experiment to see what order works best as follows:

(1) = 0 (Black)
(2) = 7 (Dark purple)
(3) = 6 (Dark green)
(4) = 4 (Dark blue)
(5) = 3 (Red)
(6) = 5 (Yellow)
(7) = 2 (Light blue)
(8) = 1 (White)

Let us then imagine that in reading a neighborhood, you find the following colors:

0 1 2
0 7 5
6 0 4

Before (or during) averaging, convert the colors using the table. The results will be:

1 8 7
1 2 6
3 1 4

At this point, the lower the number, the darker the color. The higher the number, the brighter the color.

Now average all pixels except the center pixel:

$$(1 + 8 + 7 + 1 + 6 + 3 + 1 + 4)/8$$

The result is 3. Now determine which pixel is to be plotted:

NEW PIXEL = ARRAY (RESULT)
or
NEW PIXEL = ARRAY (3)
or
NEW PIXEL = 6

It is very important to note that when doing pixel averaging, the smoothest results are obtained if the background is black. Bright backgrounds cause jaggies, so keep the background to the darker colors if not completely black.

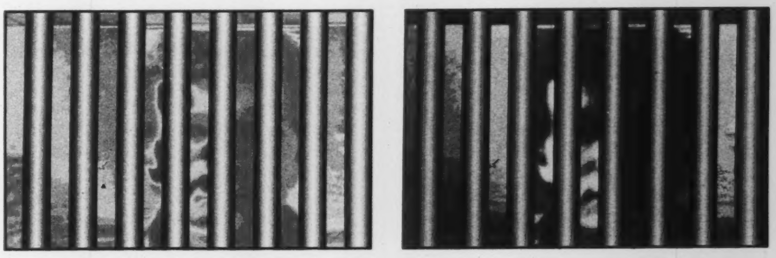
Continued pixel averaging causes the image to glow more and to become less jagged with every pass.

You may be wondering why we don't average the center pixel. The reason for this is that our routines are in assembly language which makes dividing by 8 much faster than dividing by 9. The center pixel does not weight the algorithm too much, but if you do decide to include it, make sure to divide by 9, not 8.

Uses Of Pixel Averaging

I call the type of pixel averaging mentioned above *Replace Averaging* as the result is replaced directly on the screen. Replace averaging is best used for one of the following functions:

Clean noise from a digitized image. Replace averaging reduces (by averaging) all noise inherent in digitizing. Continued averaging will slowly reduce



**Figures 15 and 16. This photo was created in two steps. The first was to take shaded bars and to Or average them to create the effect of light shining from an angle. The second step was to take a picture of the Wag (Douglas Wagley) and Replace average out some of his facial features. Next, various objects in the background (such as a light switch on the wall) were edited out of the image. Finally, the bars were Copied over Doug and then Xored to erase them. The bars were then shot as one exposure and Doug as the second exposure.*

all random grey scale elements, causing the digitized image to appear computed as opposed to digitized.

Clean up jagged lines in computed drawings. Replace averaging only once on a line drawing (or solid shape) has the effect of blurring all borders and edges. This reduces the jagged edges inherent in low resolution drawings. Continued pixel averaging causes the image to glow more and to become less jagged with every pass. You will obtain cleaner graphics if before averaging, every color except background in the image is converted to the lightest color. This places the entire image at the top of the color map with the background at the bottom. Averaging at this point slowly and smoothly pulls the color of the outer edges of the image toward the color of the background.

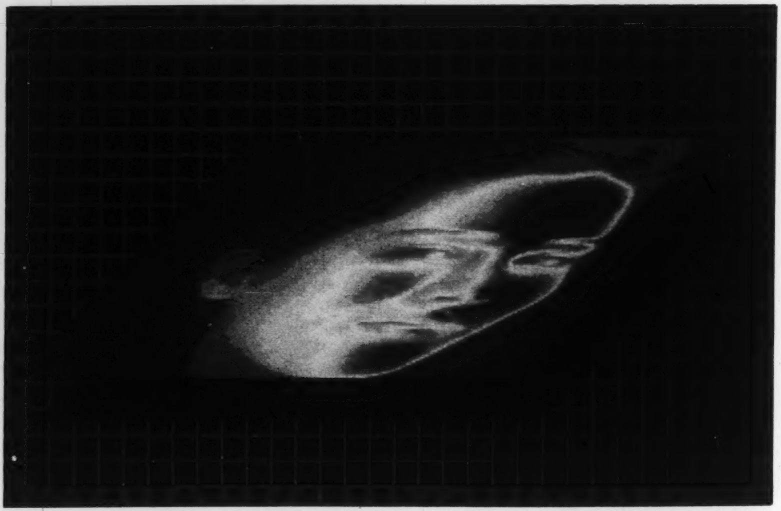


Figure 17. This photo was created by taking in a picture via the video camera and tilting it through software. This was then Copied on top of the grids and then Xored to cut the picture out leaving the shadow. The picture was then moved up and Copied back in. Finally the picture was Replace averaged and randomly colored to provide linked shading.

Variations On A Theme

Once you understand basic Replace averaging, variations are simple to implement. From here on we will deal with very simple variations on Replace averaging which provide many different results. Some of these variations are dependent on the color map being shaded, others are not. Therefore, some of them will be useful to anyone who has a computer with graphics capabilities whether it has color or color maps or not.

Edge Detection

Sometimes it is useful to be able to detect just the edges (boundaries between colors or grey shades) of images. Uses range from art, to being able to detect, identify and track a fast moving missile via computer (and I don't mean video games).

Normally, edge detection is accomplished by taking a copy of the image, shifting the copy one pixel up and one pixel to the right and then xoring the copy back over the original. This method leaves most edges with the exception of corners and overlapping lines.

A much faster and smoother algorithm is one I call Subtract averaging. Subtract averaging is identical to Replace averaging with the exception that when the result is obtained from averaging the neighbors, it is subtracted from the original center pixel before being plotted to another page or area on the screen.

Note that you *must* plot the result somewhere other than on top of the original image or the effect you get will not be edge detection.

If Subtract averaging is handled properly, what you should end up with is an image consisting of only borders and edges from the original image. Xoring the result and the original center pixel (Xor averaging) instead of subtracting also performs edge detection with the exception that the detected edge is not quite as clean as it is with Subtract averaging.

Other forms of pixel averaging fit themselves to unusual forms of texture and pattern generation.

The following is an example showing exactly where the subtract should appear (this holds true for all other types of fuzzing mentioned below):

P = Color assignment of original center pixel before averaging

P1 = Color assignment of new center pixel after averaging but before plotting.

Before plotting the pixel, perform this calculation:

$$P2 = P1 - P$$

And plot P2.

Edge detection is best to use on solid shapes or digitized images. If you are using it on a digitized image, it may help to reduce the noise in the picture first by Replace averaging the image before Subtract averaging. Remember, all noise in an image will show up as edges during edge detection.

Texture And Pattern Generation

Other forms of pixel averaging fit themselves to unusual forms of texture and pattern generation. Two good examples of this are Subtract and Xor averaging *on top of* the existing image. If the user Subtract averages *twice* in succession, replacing each pixel on top of the original, and then applies a grey scale to the image, the image will appear pitted and very three dimensional (much like the surface of the moon). The image can then be Replace averaged to make the features blend in and soften the image.

Xor averaging on top of the existing image also causes unusual patterns to appear. Xor averaging again does not cause the picture to revert back to normal but instead modifies it further.

Intensity Modifications

And averaging *on top of* the original image causes only the brightest shades to remain and all darker shades to be lowered in intensity. This also provides more depth (encoded via shade) to an image and is useful in intensity control.

Color Map Wraparound

Add averaging *on top of* the original image or to another area of memory causes the shades to begin to wrap

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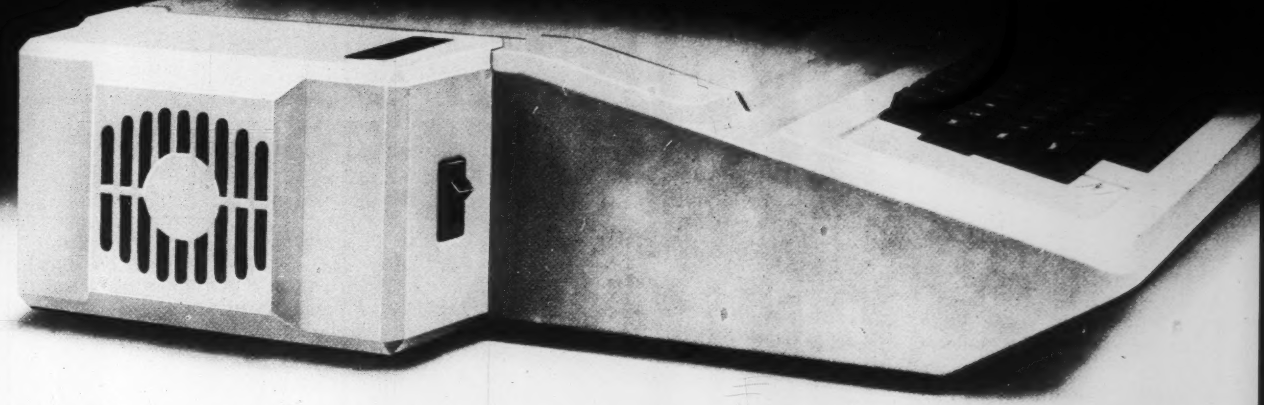

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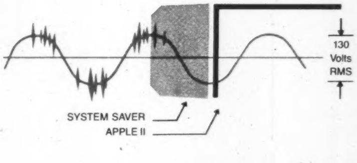

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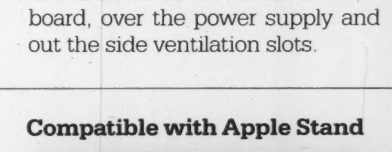

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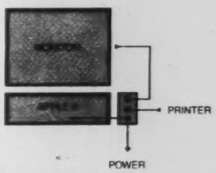

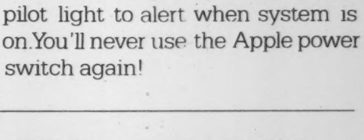

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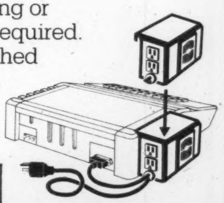

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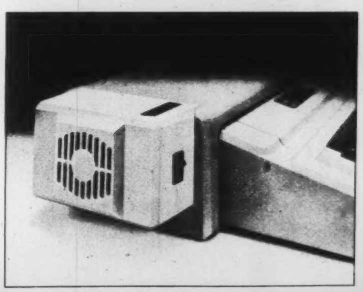

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Pixel Averaging, continued...

Figures 18-32 show how each type of averaging affects a digitized image.

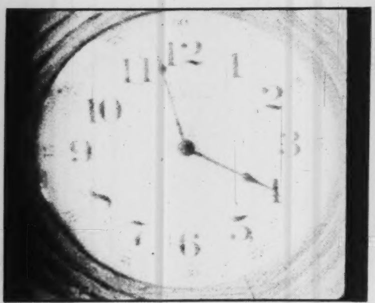


Figure 18. This photo is the original. No averaging or manipulation was performed on the image. The image is shown as it came into the computer.

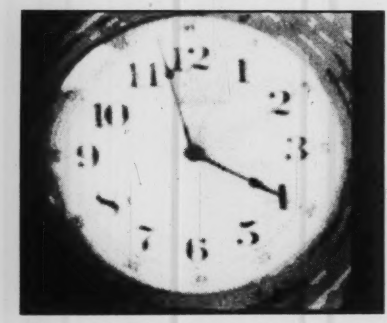


Figure 19. This photo shows Figure 18 Replace averaged on top of itself once. Notice that noise is slightly reduced. Continued averaging would reduce the noise more. Also notice the patchy coloring. This is due to the accumulating error caused by replacing the averaged information on top of the original.

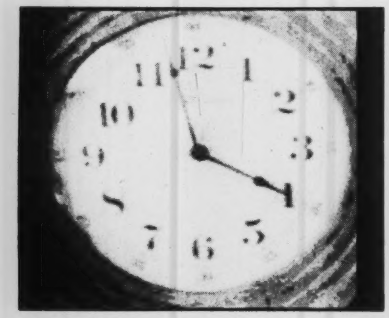


Figure 20. This photo shows Figure 18 Replace averaged to the alternate page. Notice the noise is reduced and very clean. Continued averaging would reduce the noise more and begin to make the image glow. Notice that no patchy coloring is found as there is no accumulating error.

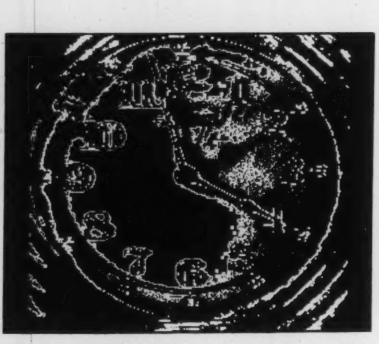


Figure 21. This photo shows Figure 18 Xor averaged to the alternate page. The effect performed is basically edge detection with shading added. This effect is almost identical to the results obtained if the image is shifted one pixel up and one pixel to the right and then Xor copied back on top of the original (as discussed in the article). This type of edge detection differs from Subtract averaging to the alternate page in that it is not as clean as Subtract averaging and produces a shaded output.

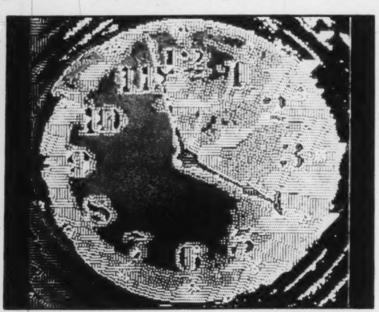


Figure 22. This photo shows Figure 18 Xor averaged on top of itself once. This manipulation is useful for introducing patterns into images.

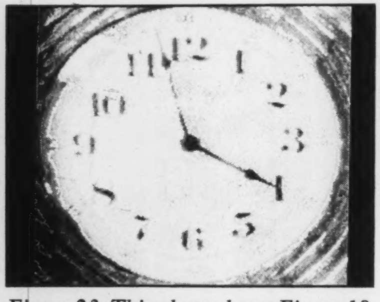


Figure 23. This photo shows Figure 18 Or averaged to the alternate page. The effect here is to add highlights to edges at angles giving the effect of light shining from an angle (more apparent on computed images than on digitized images).

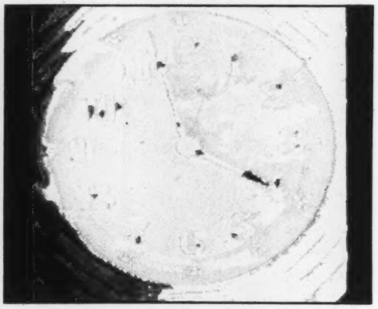


Figure 24. This photo shows Figure 18 Or averaged on top of itself once. The effect here is basically identical to Figure 23 with the added accumulating error which is greatly evident. This effect is nice for a "washed out" look.

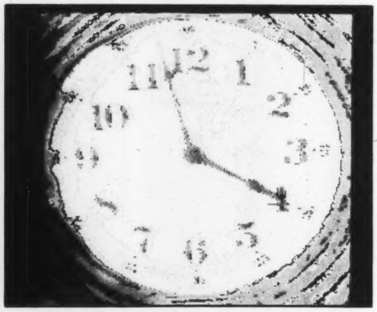


Figure 25. This photo shows Figure 18 And averaged to the alternate page. The effect here is basically the opposite of Or averaging to the alternate page. Places where Or would highlight, And will deaden.

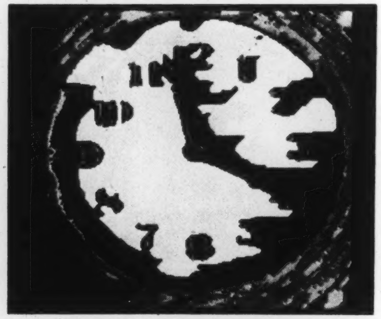
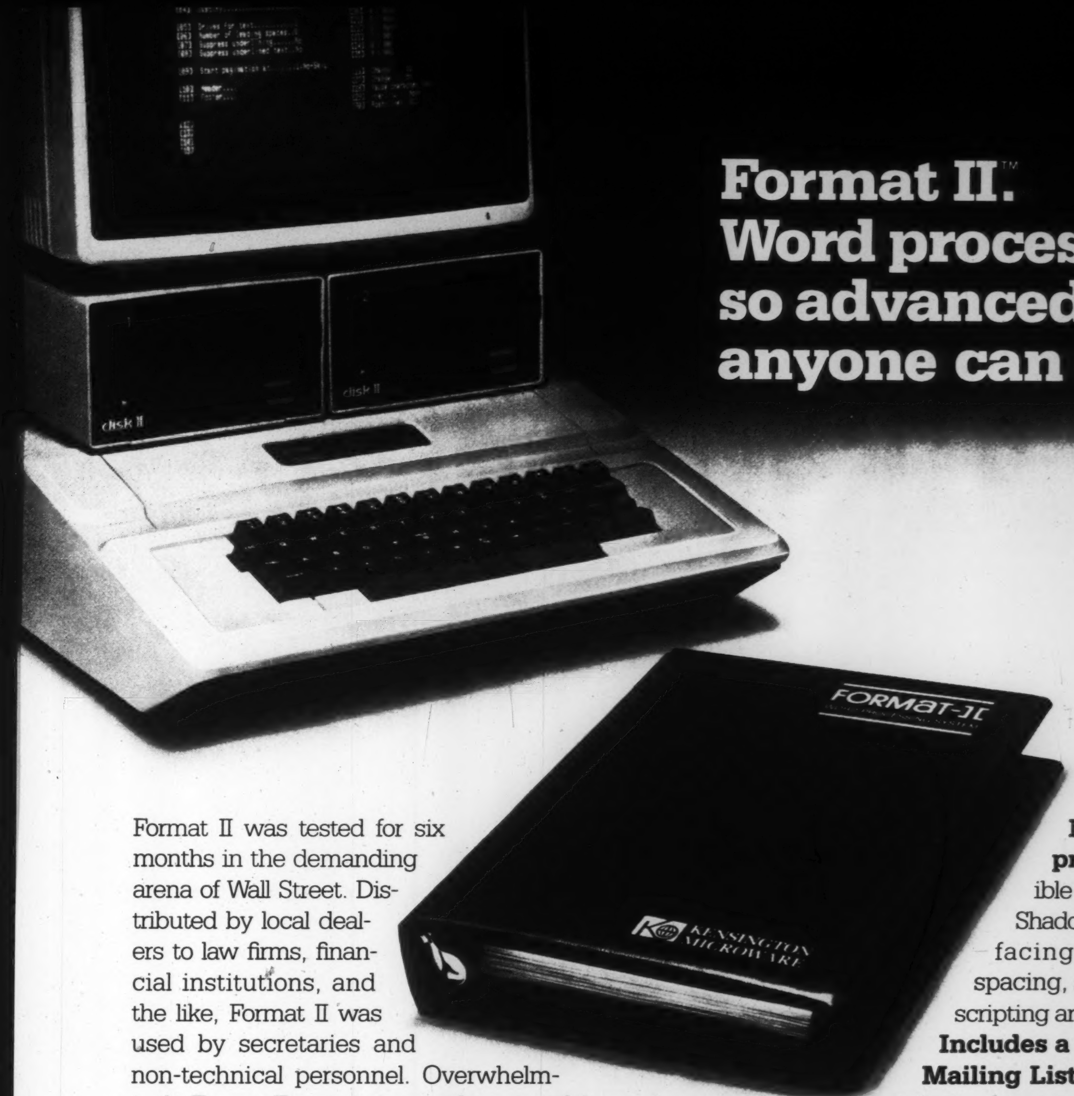


Figure 26. This photo shows Figure 18 And averaged on top of itself once. This is very useful for non-linear intensity reduction. The intensity reduction is non-linear because of the accumulated error. This method may also be used to introduce shadows into an image.



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around the color map. This effect causes bright shades to become darker and darker shades to become lighter. It differs from simply inverting the color map (or the image) by keeping the association between the color scales the same.

High Lighting

A very useful feature is Or averaging to another area of memory. If applied to a computed image (words or shapes) it causes highlights (brightest color map values) to be added to edges and corners making the image appear to gleam as if from reflected light.

If several Or averages follow each other on the same image (each time reverting to another place), and the final result is Replace averaged, the very brightest highlights will be reduced to stars.

Conclusion

While there are many other techniques which must be employed to obtain the smoothest graphics possible, pixel averaging and all of its variations provide a good stepping stone into the world of smooth graphics. The following is a list of ideas to try once you have forms of pixel averaging working:

- Average larger neighborhoods than the ones I describe here. This results in various degrees of cleaner output.
- Try averaging the center pixel along with the neighbors (just remember to divide by 9 rather than 8).
- Try using all forms of averaging mentioned in this article to become familiar with the results of the variations listed in Figure 2.
- Try combining the different forms of averaging mentioned here.
- Add new types of averaging (formula averaging where a complex formula may be executed for each pixel).
- Add the types (Replace, Subtract, Add, Xor, Or, And) to other graphic tools such as loading images from disk. Try adding the image from disk onto the screen, or subtracting or xoring.

In conclusion, the basic ideas presented in this article do not deal as much with pixel averaging as they deal with modifying a basic algorithm over and over again to provide new and diversified effects. In graphics where memory is a consideration, if the same routine can be used in many different effects, the routine becomes a valuable tool and a basis for the design of other routines using the same concepts. ☐

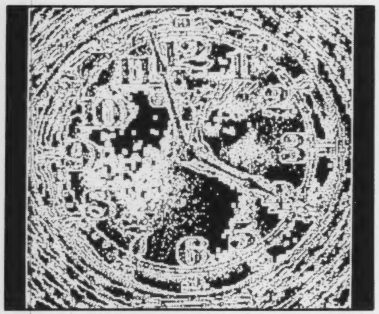


Figure 27. This photo shows Figure 18 Subtract averaged to the alternate page. The effect here is Edge Detection. Because the image contains so much noise, there are many edges detected. To reduce the number of edges, Replace average first. Figure 32 is an example of Figure 18 which has been Replace averaged before Subtract averaging.

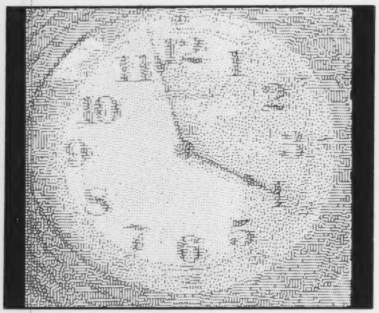


Figure 28. This photo shows Figure 18 Subtract averaged on top of itself once. This effect is useful in pattern generation and masking.

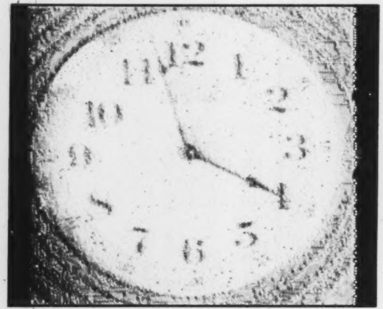


Figure 29. This photo shows Figure 18 Subtract averaged on top of itself twice. If Subtract averaging on top of the original is used an even number of times, it produces more and more three-dimensional textures. These textures appear as tiny bumps and valleys with shadows. This is a very good method of producing high-altitude type images of ground features.

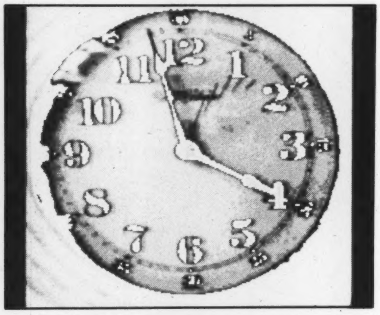


Figure 30. This photo shows Figure 18 Add averaged to the alternate page. The effect here is to wrap the pixels around the color map without adjusting it.

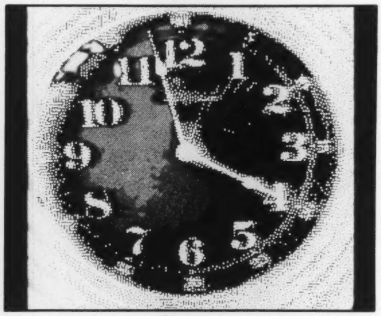


Figure 31. This photo shows Figure 18 Add averaged on top of itself once. This effect is very beautiful due mostly to the accumulated error. It is a very good effect to combine with other forms of averaging.

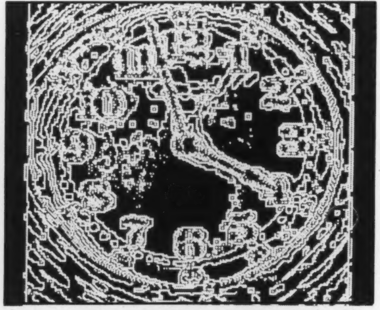
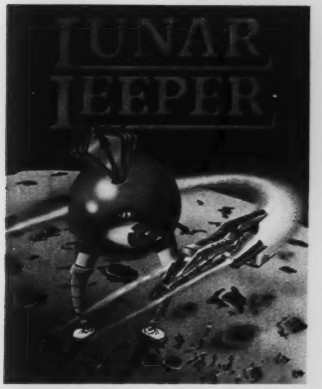


Figure 32. This last photo is an example of Figure 18 Replace averaged to the alternate page to reduce noise, and then Subtract averaged to the alternate page to edge detect. The detection here is very clean and can be made cleaner by Replace averaging several times before Subtract averaging.

JEEPERS CREEPERS!

DON'T KILL THEM LEEPERS!



Them leepers is cute.
Them leepers ain't kind.
Them leepers will jump up
and bite your behind.

Your job is to fly through
them leepers galore
to rescue some men
is the reason what for.

So be a good pilot
be quick and be sly
Don't kill the leepers
but shoot up the eye

Save all the men
and avoid all the leepers
fly through a cave
and shoot the lunar leepers keepers

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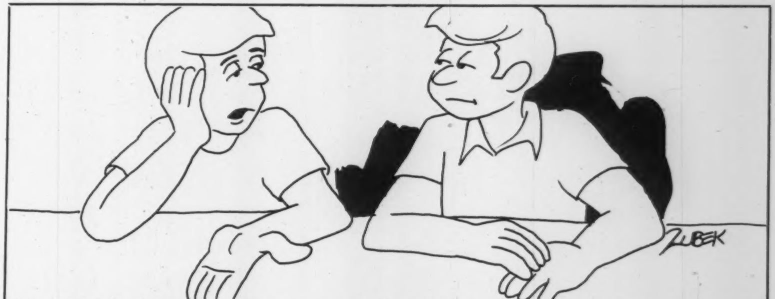
Pixel Averaging, continued...

Table 2.

Type	Result Same Image	Result Other Area
Replace	Noise reduction Jaggie reduction	Glows and noise reduction Jaggie reduction
Subtract	Texture generation	Edge detection
Xor	Pattern generation	Shaded edge detection
Or	Highlighting	Highlighting
And	Intensity reduction	Anti-OR to alternate page
Add	Map control	Map control

Listing 1.

```
C..
C..  This is a sample FORTRAN program which will take an entire screen and
C..  pixel average it using REPLACEMENT AVERAGING.
C..
      INTEGER X,Y,X1,Y1,L,AVE,COLOR
      INTEGER FRIEND (2,8)
C..
C.. Data
C..
      DATA FRIEND/-1,1,0,1,1,1,-1,0,1,0,-1,-1,0,-1,1,-1/
C..
C.. Here we begin to scan the entire screen.  Notice that while the screen
C.. resolution is 378 by 241, our loops only run from 2-377 by 2-240.  The
C.. reason for this is that the very outside border on the screen has neighbors
C.. which are off the screen, so to avoid possible error, we do not average
C.. them.
C..
      DO 120 X = 2,377
         DO 110 Y = 2,240
C..
C.. First, set the average equal to zero.
C..
            AVE = 0
C..
C.. Next we begin to look at a neighborhood.  The neighbor's offsets are held
C.. in an array called FRIEND where:
C..
C..               FRIEND (1,n) = X offset
C..               FRIEND (2,n) = Y offset.
C..                        n  = 1 to 8 (Corresponding to the 8 neighbors)
C..
C.. XREAD will return the COLOR (0-15) of point at X1 and Y1 on the screen.
C..
            DO 100 L = 1,8
               X1 = X + FRIEND (1,L)
               Y1 = Y + FRIEND (2,L)
               CALL XREAD (X1,Y1,COLOR)
               AVE = AVE + COLOR
  100       CONTINUE
C..
C.. Now caculate the average by COLOR = AVERAGE/NUMBER OF NEIGHBORS
C.. And replot the color at X and Y (Using XDOT)
C..
            COLOR = AVE / 8
            CALL XDOT (X,Y,COLOR)
C..
C.. End our loops
C..
  110    CONTINUE
  120 CONTINUE
      STOP
      END
```



"Now that I finally made it to 'star commander' in star raiders...life just doesn't seem to have any meaning."

Part 1: Making Images With Depth

STEREO GRAPHICS

John D. Fowler, Jr.

Remember 3-D movies? I still remember slinking down in my seat at the local theater, fearing that if those bats floating out over the audience didn't get me, the falling rocks would. And then there were 3-D comics with the funny red and green glasses. The pictures seemed to stand out from the page. How did they work?

Our ability to perceive depth in the world around us stems primarily from two factors: perspective and the relative angle of view between the viewer's eyes. An example of the former is the apparent convergence of parallel lines which extend to the horizon. We are conditioned to believe that the lines really don't get closer together but rather are extending away from us in depth. This use of perspective is what allows pictures of objects projected onto a flat page or screen to give the illusion of depth.

But another and more convincing sense of depth comes from the positioning of the eyes. If you must cross your eyes to focus on something, then you know it must be very close. This is why there can be no doubt in your mind when you see a 3-D movie that it is different from a regular movie, even though both are projected onto a flat screen.

The difference between perspective and depth perception in pictures is that perspective requires only one image, but it takes two separate images to create a really convincing sense of depth. This is directly related to the fact that you have two eyes in the front of your head. This ability to perceive how far away an object was proved to be a great headache-preventer for our tree-dwelling ancestors.

If you want to create an image, a mirage if you will, out of flat paper, then you must do two things: draw two images in perspective, and assure that each eye sees only the appropriate image. In 3-D movies this is accomplished by projecting both images onto the same screen, in more or less the same place.

For color movies, two projectors are used. The images are sorted out by the use of polarizing filters over the projector lenses and similarly-oriented filters in the glasses you must wear. The light coming from the right projector, for example, is horizontally polarized and the light from the left is polarized vertically. Then the filter over your right eye, which is horizontally polarized, passes light only from the right projector and that eye sees only the image intended for it. The rest of the light on the screen shows up in your left eye and, *voila*, each eye receives the intended image. Your brain, working on these images, notices the similarities (and vital differences) and forces you to duck when those bats come fluttering out over the audience.

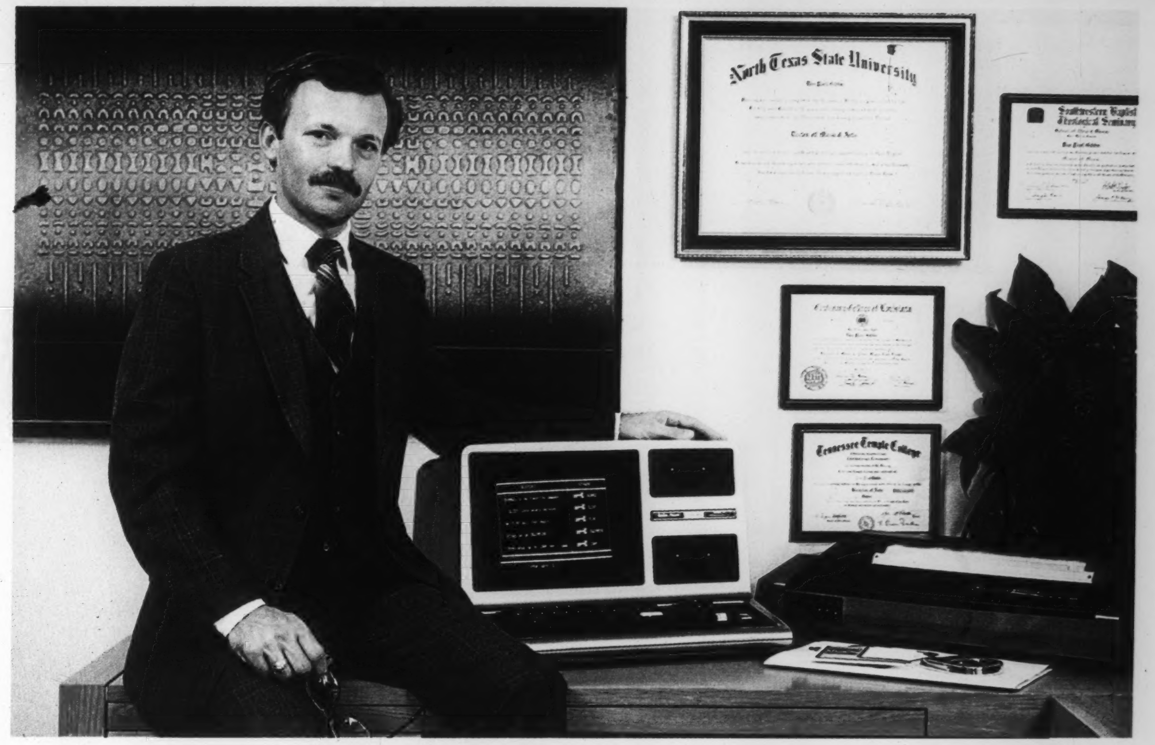
If you put the glasses on upside down, so that the images go to the wrong eyes, you can still see the picture, but the essential depth information no longer corresponds to experience. The picture looks strange in a way that is difficult to describe, and no longer gives the proper illusion of depth.

Non-color 3-D movies and comics work on the same principle, but use red and cyan (sort of greenish blue) colors and filters. Red and cyan are complementary colors. A red line can't be seen through a red filter (because it looks just like the red background), but a cyan line looks black. And vice-versa for the cyan filter. So one eye gets the red image and the other eye the cyan.

The real problem in making your own stereo pictures with a computer comes in getting the proper image to the proper eye. Several possible methods will be discussed.

If you have two slide projectors and the equipment to photograph your display, you can buy some polarizing filters and do it as in the movies: properly oriented filters over each lens with corresponding filters over the eyes. Or, if you are satisfied with red and cyan images and want to experiment with different colored pens and filters, you can do it that way. But beware: light blue pens are hard to find.

John D. Fowler, Jr., 946 Capulin Road, Los Alamos, NM 87544.



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Colored and polarizing filters can be purchased at a photographic supply store.

Another approach is to use lenses. You have probably seen the stereo viewers on the market. They have two lenses through which you can view images from disks containing small pieces of film which are inserted into the viewer. You must make the center-to-center distance of the images less than the distance between your eyes. This means that the images must be rather small. A viewer can be made by placing a small magnifying glass in front of each eye.

There is another method which requires no extra equipment at all. The drawback to this method is that it takes a degree of voluntary control over the eye muscles which some people lack. If you can make your eyes diverge slightly (the opposite of crossing them), you can try pointing your left eye toward the left member of an image pair and the right eye towards the right image. If you can still focus on the images, you've got it made. You also have a rare talent because very few people can do this.

A variation of this method is to cut out the images and reverse them, so that the image intended for the left eye goes on the right. The trick now is to cross your eyes slightly so that the left eye sees the right image, and vice-versa. One aid in doing this is to cup your hands a few inches in front of your face and look through the hole. Or you can cut a rectangular hole in a piece of cardboard and view the images through it.

The real problem in making your own stereo pictures with a computer comes in getting the proper image to the proper eye.

The problem that most people encounter with these methods is that there exists a semi-voluntary coupling mechanism between the interocular muscles (the ones that control the relative angles of your eyes) and the muscles which focus the eyes. You must focus on an image (really two images) which are farther away than your interocular muscles are telling your brain they should be. Some people can do this and some can't. If all this leaves you dizzy, then go on to the next method, which works for almost everyone.

Perhaps the best way to view stereo images is through an inexpensive viewer made from cardboard and mirrors. To construct the viewer, you will need four small rectangular mirrors (approximately 1½" x 2"), some sturdy cardboard, double-stick tape, and glue. The pocketbook mirrors, which can be found at a variety store, will do nicely. You may have to remove the plastic cases by boiling them to loosen the glue. Heavy-duty photographic mounting board works well for building the frame. In addition, you will need some small strips of wood or plastic for sturdiness and to form the necessary 90 degree angles. I used decorative molding strips for this.

Construct the viewer, as shown in Figure 1, by first cementing the rear short sides of two of the mirrors to a piece of molding strip to form a right-angle V. Next glue a piece of molding strip to the back side along one of the long edges of each of the other two mirrors. While the glue is drying, you can cut two pieces of cardboard to the

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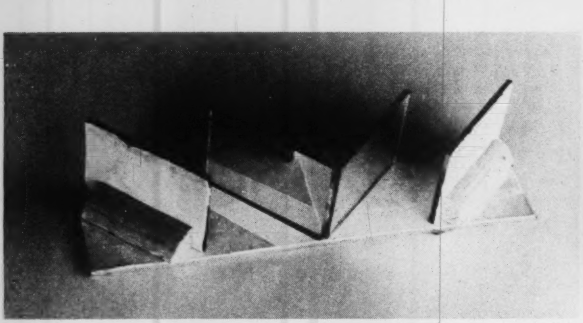


Figure 1b. Photograph of partially assembled viewer.

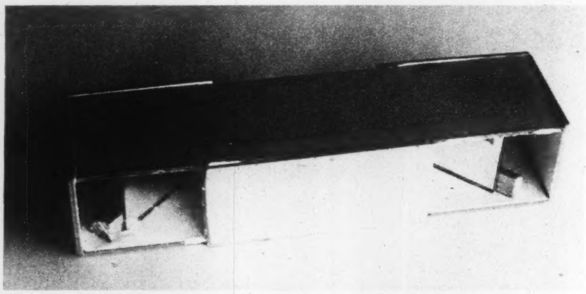


Figure 1c. Fully assembled viewer with additional strips of cardboard on sides to exclude light.

dimensions shown in Figure 1(a). Transfer the lines, as shown in the figure, to one of the pieces, then put down a layer of double-stick tape.

After the glue has dried, take the middle pair of mirrors, and align them with the V you have drawn on the cardboard base. Place the outer two mirrors along the other two lines on the base, with the reflecting sides facing each other. The molding strips you glued to the bases of these outer mirrors should be against the tape, holding them in place.

Now you can pick up the viewer and look at the stereo figures which accompany this article. You will probably have to make slight adjustments in the mirror positions to get the images to line up and appear as one. This is the reason for using the double-stick tape. Take your time and get the mirrors just right, so that you comfortably see a single 3-D image. (You will also be able to see other images from unwanted reflections, but we will take care of them shortly.)

When everything is lined up, put on the top piece of cardboard and glue the mirrors in place. Finally, as shown in Figure 1(b), you should apply cardboard wherever possible to the four sides of the viewer to keep out extraneous light (without, of course, obstructing the view of the images you want to see).

In what follows, we will go through the steps required to write your own programs and make stereo images like those shown here. I will give you the subroutines and main programs you will need, except for the plotting routine.

The statement GOSUB PLOT probably won't work on your system. In place of PLOT you must insert the line number for your plotting subroutine. In most cases, the plotting subroutine will be quite simple: a command to draw a straight line from one point to another, followed by a RETURN statement. Variables used in the listings are defined in Table 1.

We will be considering three objects: the viewer, the object to be displayed, and the display itself (monitor, plotter, or printer). To establish a frame of reference, we will create a coordinate system with its origin in the center of the display. The X and Y axes are in the plane of the display, with X increasing to the right and Y increasing upwards. The Z axis comes out of the display toward the viewer.

As shown in Figure 2, the axes are labeled with capital letters, while the coordinates of objects use lower-case letters. (Only capital letters will be used in the listings.) Viewer coordinates are (x, y, z), coordinates of points in the object to be plotted are (a, b, c), and points on the display surface are labeled (m, n, o) or just (m, n) since the Z coordinate always equals zero on the display surface.

For the time being, let's content ourselves with producing a single image on the display. (After this has been accomplished, it will be easy to produce two images, one for each eye.)

Pretend that you are holding a pencil in front of your display and that when you remove it, you want an exact image of the pencil as you saw it to remain on the display. To do so, we must draw an image on the display, corresponding to the original "real" image of the pencil, which was displayed on the backs of your eyeballs. When the pencil is removed and only the display remains, we want the image on the back of your eye to remain unchanged.

This can be done by thinking of the pencil as being made up of a bunch of points each of which is transferred, one at a time. For each point on the pencil, we want to set the corresponding point which is directly behind it on the display. This point on the display can be found by extending a straight line from the viewer's eye, through the point on the pencil, to the display. Do this for each point on the pencil, and when you remove it your eye will see the identical image on the display. (Note in what follows that the pencil could just as well be behind the display as in front of it.)

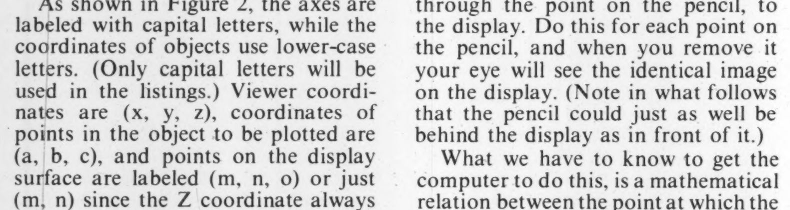
What we have to know to get the computer to do this, is a mathematical relation between the point at which the viewer exists, the points which make up the pencil, and the corresponding points on the display. Figure 2 shows a stereo view of just one point and the projection from the eye through the point to the screen. Looking down from above, as in Figure 3, we can see that for X coordinates the needed relation between viewer, object, and display is expressed by the equation:

(1a) $m=a+(a-x)*c/(z-c)$.

Likewise, if we were to view the figure from the side, it would be apparent that for Y coordinates the equation is:

(1b) $n=b+(b-y)*c/(z-c)$.

Figure 1a. Viewer template. Lines at 45° angles should be one mirror length.



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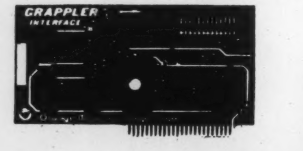

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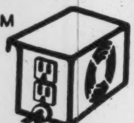

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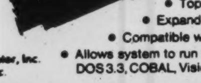

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And that's all there is to drawing perspective images. You put in a coordinate for the viewer (x, y, z) and a series of coordinates for the object (a, b, c) (or let the computer calculate them), and then plot the resulting m and n (horizontal and vertical) numbers on the display.

That was so easy, let's try something else before getting to the stereo part. How about rotating the object before plotting it? Once again, since objects can be thought of as sets of points, we need only consider how to rotate a single point about each of the axes.

In Figure 4, we see the result of rotating a point about the Z axis. Using a little trigonometry, and calling the rotated point (a1, b1, c1) we get:

$a1 = a*\cos\theta - b*\sin\theta$,
$b1 = a*\sin\theta + b*\cos\theta$, and
$c1 = c$.

If we now use a1, b1, and c1 in equations 1(a) and 1(b), instead of a, b, and c, the projection of the object onto the display will be rotated by the angle θ.

To rotate about the X and Y axes, you do the same things to the b and c coordinates or to a and c. Putting all of this together, we arrive at the Master Rotation-Perspective Subroutine which starts at line 1000 in Listing 1.

Since this subroutine will be executed a great many times, it is desirable to make it run as fast as possible. Thus, the sines and cosines of the rotational angles are calculated only once, near the beginning of the program.

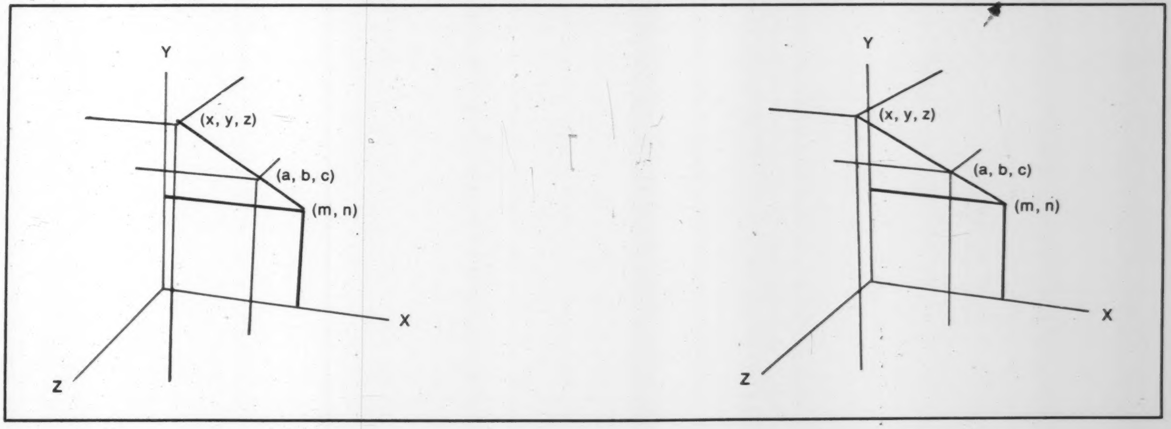
There are several other neat things you can do with this subroutine. Notice the variables Q and W in Listing 1. These can be used to displace the image on the display. For instance, if the origin of coordinates on your system is in a corner instead of the middle, you can insert appropriate values for Q and W to move the display point (0, 0) back to the center.

A	X coordinate of point in object to be displayed
A1	A after rotation about Z axis
AA	A1 after rotation about Y axis
B	Y coordinate of point in object to be displayed
B1	B after rotation about Z axis
BB	B1 after rotation about Z axis
C	Z coordinate of point in object to be displayed
C2	C after rotation about Y axis
CC	C2 after rotation about X axis
CF	Conversion factor for degrees to radians
CP	Cosine of rotational angle about Y axis
CS	Cosine of rotational angle about Z axis
CT	Cosine of rotational angle about X axis
FG	Toggle variable (alternates between 1 and -1)
I	Loop index
J	Loop index
K	Loop index
M	X coordinate of point on display
N	Y coordinate of point on display
PEN	Current pen (color) number
PH	Rotational angle about Y axis
PI	3.14159265
PLOT	User-supplied line number of plotting subroutine
PN	Temporary value of PEN
PS	Rotational angle about Z axis
Q	Display X coordinate of origin
R	Radius of a circle (distance between two points in Listing 7)
SP	Sine of rotational angle about Y axis
SS	Sine of rotational angle about Z axis
ST	Sine of rotational angle about X axis
TH	Rotational angle about X axis
W	Display Y coordinate of origin
X	X coordinate of viewer
XRES	Number of resolvable units on X axis of display
XX	X coordinate of polygon vertex
Y	Y coordinate of viewer
YRES	Number of resolvable units on Y axis of display
YY	Y coordinate of polygon vertex
Z	Z coordinate of viewer

Table 1. Index of variables used in listings.

The TRS-80 Color Computer has the coordinate origin in the upper left corner of the display, with a range of m from 0 to 255 and n from 0 to 192 in the highest resolution mode. Setting Q=128 and W=96 causes the point (0, 0) to be plotted in the center of the screen. So you can use Q and W to position the image on the display. On

Figure 2. Stereo projection of viewer, object, and display, illustrating projection of object image from viewer to display.



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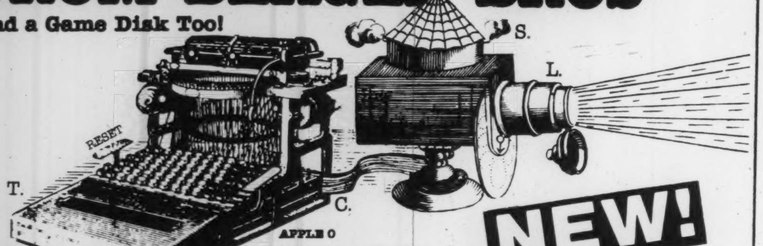

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10 HOME: SPEED=90: PRINT "OH, ARTHUR...": PRINT "I LOVE YOUR PEEKS & POKES CHART.": Z=49200: FOR X=1 TO 4: FOR Y=1 TO 9: S=PEEK(Z): NEXT: FOR Y=1 TO 150: NEXT: FOR Y=1 TO 6: S=PEEK(Z): NEXT: FOR Y=1 TO 444: NEXT: NEXT
20 PRINT: PRINT "YES, JANET... AND ONE COMES": FOR X=1 TO 4: FLASH: PRINT MID$("FREE", X, 1); CHR$(7); : NEXT: PRINT: NORMAL: PRINT "WITH EVERY BEAGLE BROS DISK.": SPEED=255

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```
10  REM HI-RES NUMBER GENERATOR
20  SIZE=5: SCALE=SIZE: REM NUMBER-HEIGHT
30  HGR: HOME: POKE 232, 0: POKE 233, 3: ROT=0
40  FOR A=768 TO 830: READ B: POKE A, B: NEXT A
50  N=N+1: N$=STR$(N): X=99: Y=0
60  FOR A=1 TO LEN(N$): HCOLOR=0: DRAW 8 AT
    X, Y: HCOLOR=3: DRAW VAL(MID$(N$, A, 1))
    AT X, Y: X=X+SIZE+SIZE: NEXT A: GOTO 50
70  DATA 20, 0, 24, 0, 27, 0, 31, 0, 35, 0, 39, 0, 44, 0,
    49, 0, 52, 0, 57, 0, 53, 62, 36, 0, 49, 38, 0, 53,
    55, 61, 0, 53, 23, 37, 0
80  DATA 46, 38, 52, 0, 61, 46, 62, 5, 0, 61, 54, 37, 7,
    0, 53, 38, 0, 54, 37, 60, 46, 0, 53, 39, 53, 62, 5, 0
```

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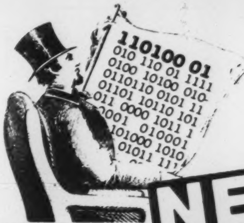

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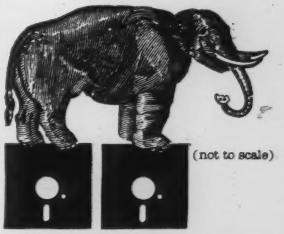

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CIRCLE 118 ON READER SERVICE CARD

some systems, the Y coordinate on the display is positive downward instead of upward. To keep things from coming out upside down, you can change line 1080 to:

```
1080 N=-(BB+(BB-Y))*CZ+W.
```

Another operation, similar to moving the projection of the object around the display, but not quite the same, is translation of the object itself before the projections (m, n) are computed. This corresponds to actually moving the object to a new position. To do this you must add the statement:

```
1055 RETURN
```

to Listing 1. Then a GOSUB 1000 will calculate the rotated coordinates of the object only. You can then add or subtract displacement coordinates to the rotated coordinates (aa, bb, cc) and

```
GOSUB 1060
```

Now that you know how to plot images of points (a, b, c) in perspective, as seen from a view position (x, y, z), you are ready to make stereo pairs of images. The only thing left is to plot the same object from two view points, one for each eye.

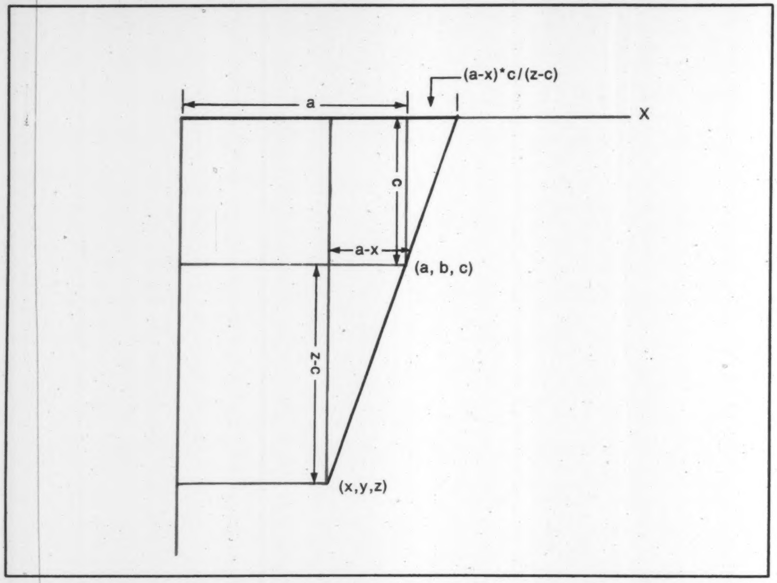
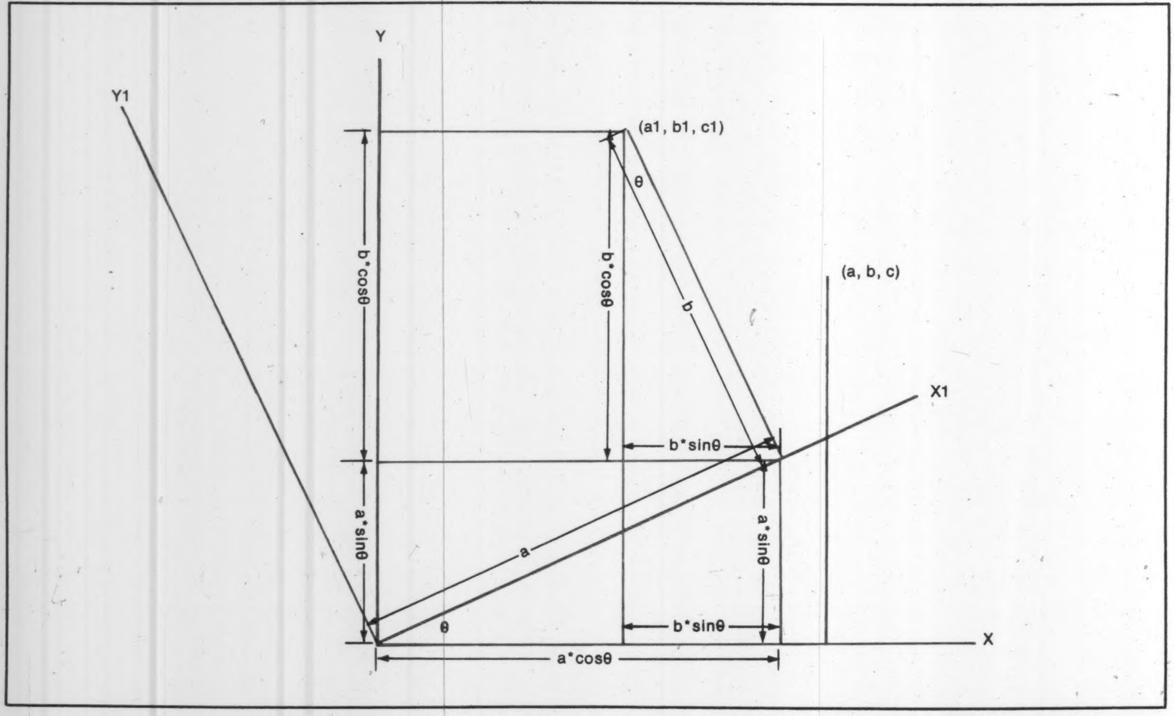


Figure 3. Top view of viewer-object-display relationship. Notice that the legs of the two triangles have the same ratio.

Usually, if you are positioned directly in front of the display, the (x, y, z) coordinates of each of your eyes will be given by (es/2, 0, zd) for the right eye and (-es/2, 0, zd) for the left. The variable es is the distance between your eyes, and zd is your distance from the display. The numerical values for these variables will depend on the plotting units you use. We define one plotting unit as the distance between two adjacent points (pixels) on your display, separated by the minimum distance of resolution. As an example, my plotter has a resolution of 0.005 inch, so this is one plotting unit. Since I normally view these plots at a distance of about one foot,

Figure 4. Rotation of object by angle θ about Z axis.



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CIRCLE 261 ON READER SERVICE CARD

Stereo Graphics, continued...

Listing 1. Rotation-perspective subroutine begins at line 1000.

```
10   CF=3.14159/180
20   INPUT "PSI, PHI, THETA";PS, PH, TH
30   CS=COS(CF*PS):SS=SIN(CF*PS)
40   CP=COS(CF*PH):SP=SIN(CF*PH)
50   CT=COS(CF*TH):ST=SIN(CF*TH)
100  (Main body of program starts here.)
          .......................
1000  A1=A*CS-B*SS
1010  B1=A*SS+B*CS
1020  AA=A1*CP-C*SP
1030  C2=A1*SP+C*CP
1040  BB=B1*CT-C2*ST
1050  CC=B1*ST+C2*CT
1060  CZ=CC/(Z-CC)
1070  M=AA+(AA-X)*CZ+Q
1080  N=BB+(BB-Y)*CZ+W
1090  RETURN
```

Listing 2. Additional lines which should be added to Listing 1 to produce stereo pairs of images. Any variable which depends on XRES or YRES may need slight changes for different systems. In determining Q and W it is assumed that the display origin is in the lower left corner.

```
5    INPUT "NUMBER OF PLOTTING
     UNITS IN X AND  Y";XRES, YRES
15   X=-XRES/20:Y=0:Z=1.5*XRES
25   Q=XRES/4:W=YRES/2
900  IF Q=XRES/4 THEN 910 ELSE END
910  Q=Q+XRES/2
920  X=-X
930  GOTO 100
```

Listing 3. Add these lines to Listing 1 and 2 to draw the sphere of Figure 5.

```
90   PI=3.14159265
100  PEN=1
110  R=XRES/6
120  FOR I=0  TO 3.13 STEP PI/6
130  FOR J=0 TO 2.01*PI STEP PI/48
140  A=R*COS(I)*SIN(J)
150  B=R*COS(J)
160  C=R*SIN(I)*SIN(J)
170  PEN=1+INT(I*6/PI)
180  GOSUB 1000
190  IF J=0 THEN PEN=0
200  GOSUB PLOT
210  NEXT J
220  NEXT I
230  FOR I=PI/6 TO 5*PI/6 STEP PI/6
240  PEN=INT(I*6/PI)+1
250  FOR J=0 TO 2.01*PI STEP PI/48
260  A=R*SIN(I)*COS(J)
270  B=R*COS(I)
280  C=R*SIN(I)*SIN(J)
290  GOSUB 1000
300  IF J=0 THEN PEN=0
310  GOSUB PLOT
320  NEXT J
330  NEXT I
```

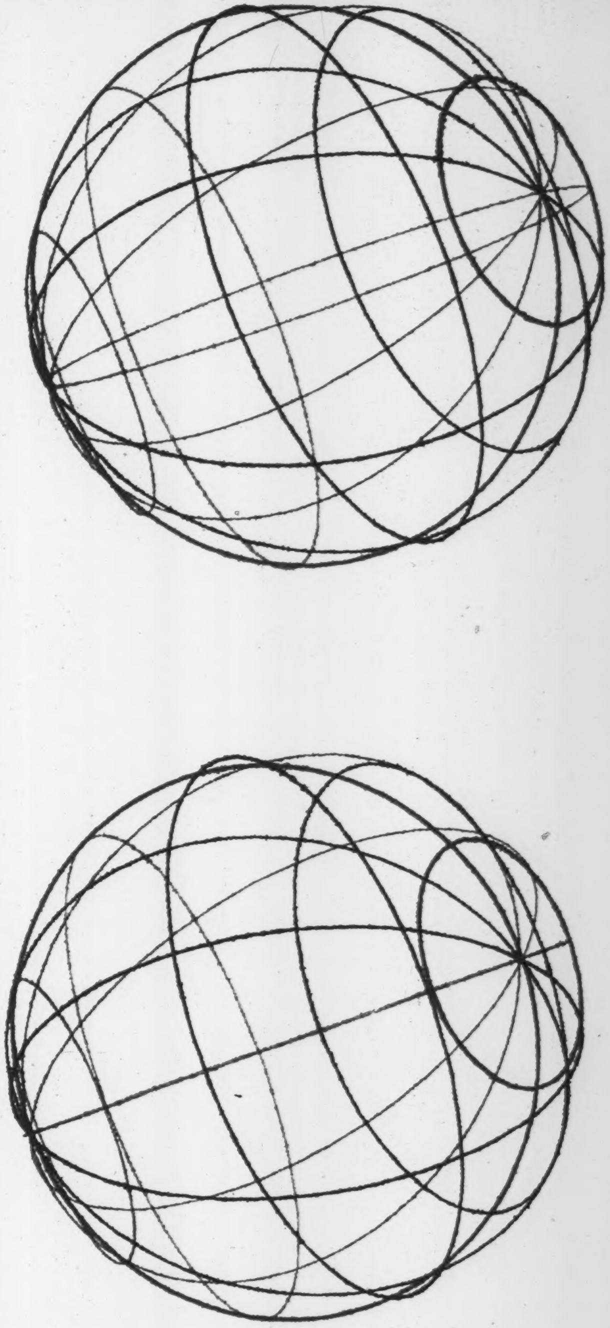

Figure 5. Sphere.

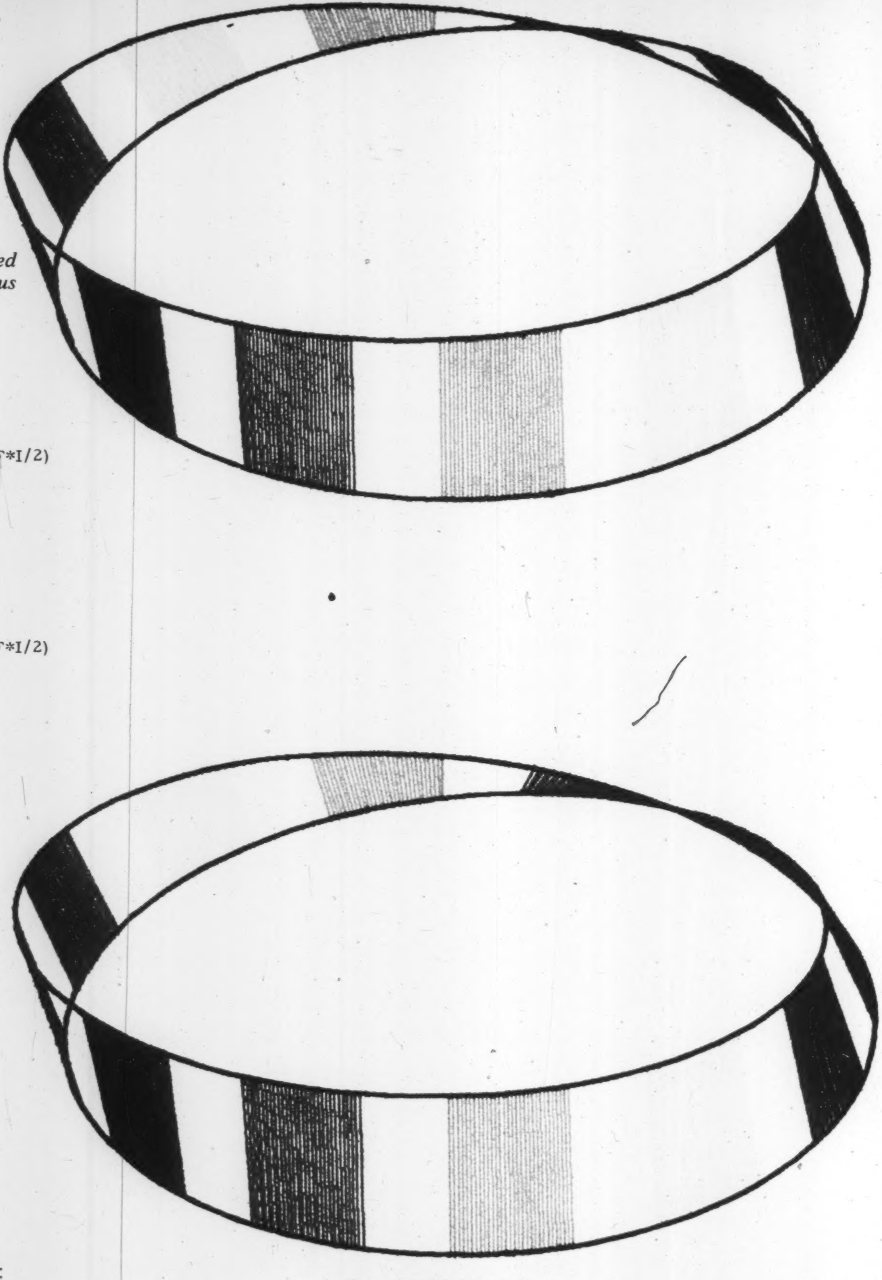

Figure 6. Mobius strip.

Listing 4. These lines should be added to Listings 1 and 2 to draw the mobius strip shown in Figure 6.

```
90  PEN=1:SS=30.05
95  RA=XRES/8:RB=XRES/
    4:RC=XRES/20
100 FOR I=0 TO 10800 STEP SS
110 A=RA*COS(CF*I)+RC*SIN(CF*I/2)
120 B=RB*SIN(CF*I)
130 C= RC*COS(CF*I/2)
140 GOSUB 1000
150 PN=PEN:PEN=0
160 GOSUB PLOT:PEN=PN
170 A=RA*COS(CF*I)-RC*SIN(CF*I/2)
180 C=-RC*COS(CF*I/2)
190 PEN=PEN+1
200 IF PEN=7THEN PEN=1
210 GOSUB 1000
220 GOSUB PLOT
230 NEXT I
240 PEN=0
250 FOR I=0 TO 720 STEP 4
260 A=RA*COS(CF*I)
    +RC*SIN(CF*I/2)
270 B=RB*SIN(CF*I)
280 C=RC*COS(CF*I/2)
290 GOSUB 1000
300 IF I=1 THEN PEN=7
310 GOSUB PLOT
320 NEXT I
330 PEN=1
```

I use:

zd=12/.005=2400.

My eyes are about 2½" apart, so:

es=2.5/.005=500.

In practice, I find a value of about 200 to be more pleasing. Making es larger enhances the stereo effect, but if it gets too big, the illusion no longer looks real. Making zd smaller corresponds to getting closer to the display.

The lines in Listing 2 can be added to those of Listing 1 to make stereo pairs of images, the image for the left eye occupying the left half of the display. To reverse the images, change line 15 to:

```
15 X=XRES/20: Y=0:
   Z=1.5*XRES
```

The variables XRES and YRES are the number of plotting units in the X and Y directions, respectively. These will vary from system to system. I have used units appropriate to my system. Some of the other variables are defined in terms of these two and you may have to experiment to get them just right for your system. In many systems, the X plotting unit is of a different size than the Y plotting unit. To make them the same, you will have to scale (multiply) one of them by the ratio of the two. Doing this will make circles come out round rather than like ellipses.

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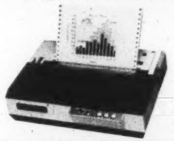

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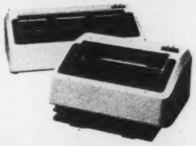

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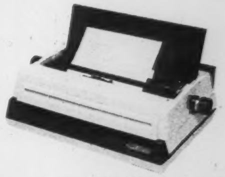

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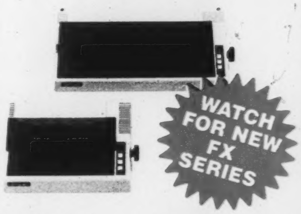

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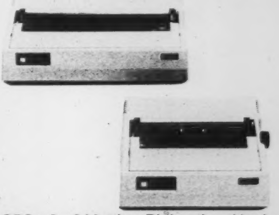

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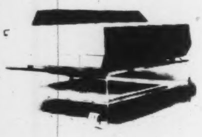

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Listing 5. These lines, along with Listings 1 and 2, create the pop art figure shown in Figure 7.

```
 90   PEN=1
 95   R=XRES/7
100   FOR I=0 TO 45 STEP 1.1
110   A=R*SIN(2*I)
120   B=R*COS(I+3.14159/4)
130   C=R*(SIN(I)+COS(I))
140   JP=I/1.1
150   PEN=INT(JP/7)+1
160   IF I=0 THEN PEN=0
170   GOSUB 1000
180   GOSUB PLOT
190   NEXT I
```

to plot stereo images of anything which can be described as a set of (a, b, c) points. These points can be calculated by the computer or input as data.

Now that we have both ends of a program, let's fill in the middle with some listings to make the drawings shown here. By the time we get through these, I am sure you will have some good ideas of your own.

If your plotting device is a video display, the resolution will probably be inadequate to show all the detail in these drawings. You may have to modify the listings to draw fewer lines. You can, of course, plot them from any viewpoint and rotation. With a video recorder, you could probably even make an animated sequence, one frame at a time.

Remember that GOSUB PLOT refers to your plotting subroutine, which simply draws a line from wherever it is now, to the point (m, n), using the color number of the PEN variable. PEN=0 means to move to the new point without drawing. The drawings shown here use up to seven different colors.

The listings which follow must be combined with Listings 1 and 2 to make an executable Basic program.

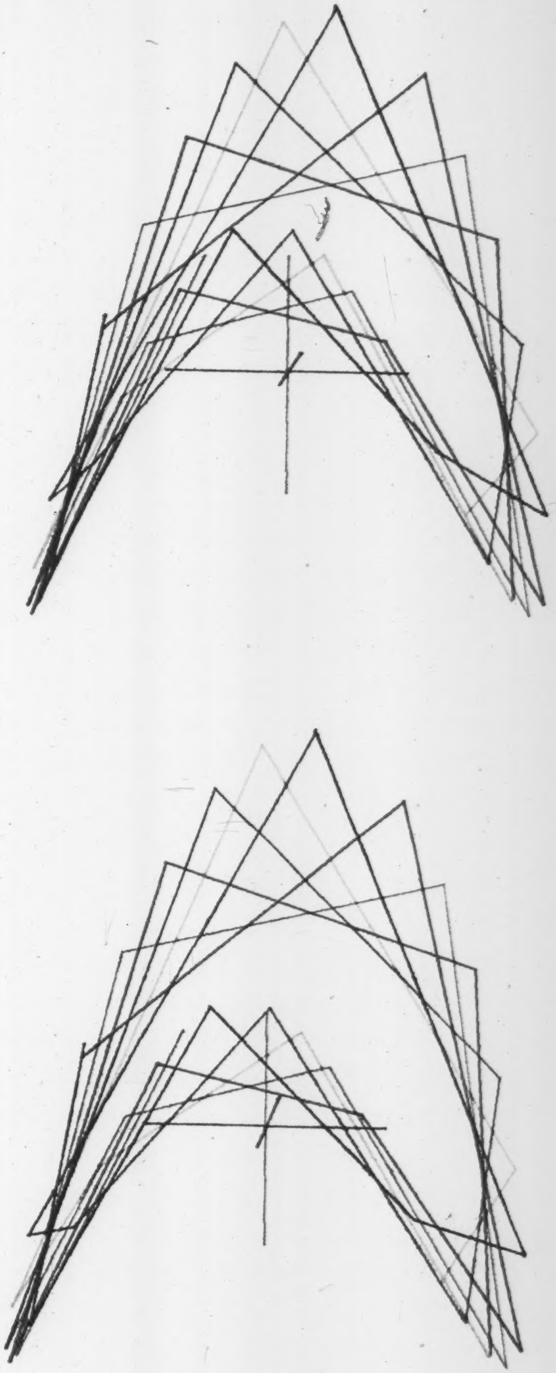

Figure 7. 3-D string art.

Listing 6. These lines were used to create Figure 8. Values for loop indices I and J may have to be altered to fit your display.

```
25  PS=0
100 PEN=1
110 FG=-1
120 FOR J=50 TO 350 STEP 60
130 FOR I=J TO J+25 STEP 5
140 A=I
150 B=0
160 C=FG*I/3+I
170 PN=PEN:PEN=0
180 GOSUB 1000:GOSUB PLOT
190 PEN=PN
200 FOR K=0 TO 20
210 A=I*COS(CF*3*K)
220 B=I*SIN(CF*3*K)
230 C=FG*I/3*COS(18*K)+2*K*FG+I
240 GOSUB 1000:GOSUB PLOT
250 NEXT K
260 NEXT I
270 PEN=PEN+1
280 IF PEN=7 THEN PEN=1
290 FG=-FG
300 NEXT J
310 PS=PS+60
320 IF PS>=360 THEN 900 ELSE 30
925 PS=0
930 GOTO 30
```

Listing 3 contains the program lines to make a sphere (Figure 5). The listing is for the high resolution sphere of Drawing 1a. Lines of longitude (from pole to pole) are drawn by lines 120–220, and latitudes are made by lines 230–330. Increasing the STEP size in lines 130 and 250 causes the spheres to have coarser resolution. Eventually they don't look like spheres at all. If the high resolution sphere looks ellipsoidal on your display, you need to scale the plotting coordinates, as described previously.

A mobius strip is a figure with just one side and a single edge. You can make one by cutting out a strip of paper, rotating one end by 180°, and taping it to the other end. To demonstrate that it has just one side, draw a line down the middle of the strip. Keep drawing until you end up where you started. You will be able to see that the

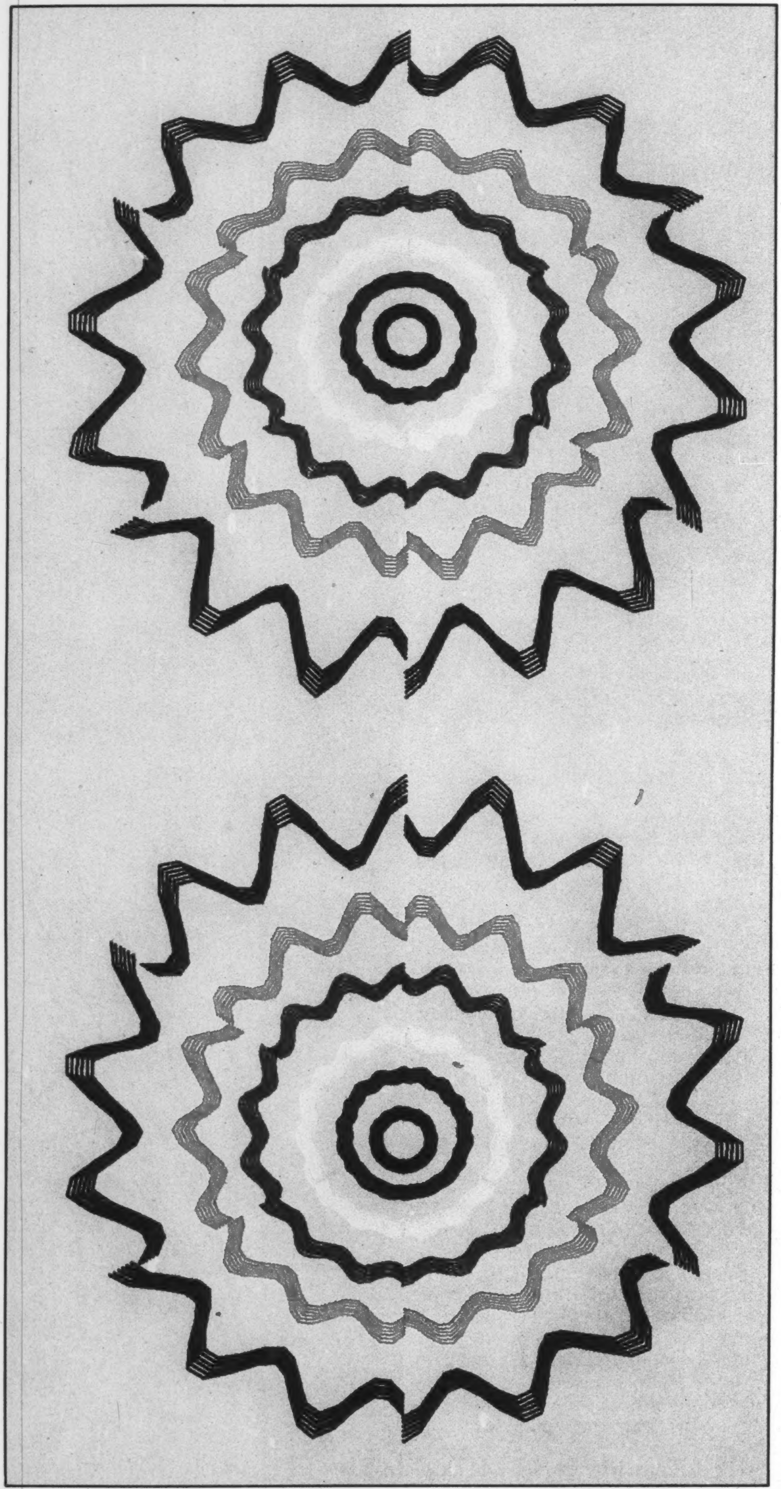

Figure 8.

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TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

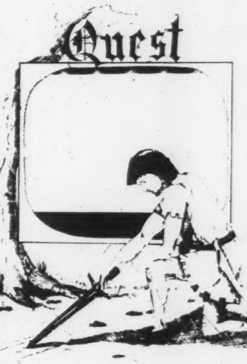
Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players - This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.



NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWIII.

Editors note to players — This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple — playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of OSI, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

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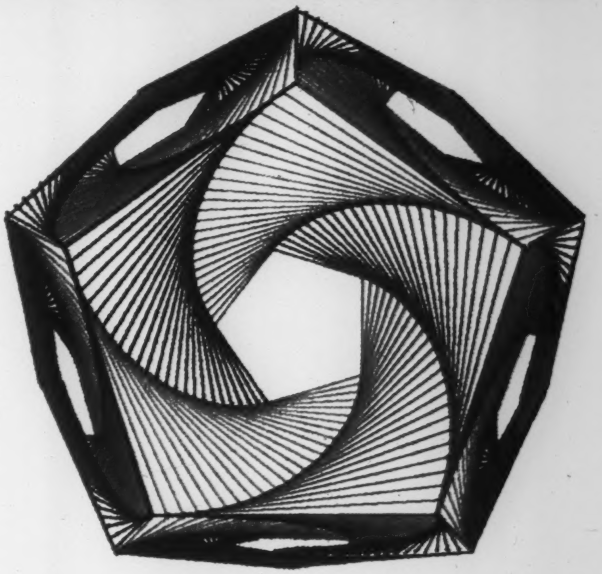
Listing 7. Lines for dodecahedron of Figure 9.

```
10    DIM XX(6), YY(6)
20    PH=0:TH=0:PS=0:CF=3.14159/180
30    INPUT "XRES, YRES";XRES, YRES
40    Y=0:X=-XRES/20:Z=1.5*XRES:Q=XRES/4:W=YRES/2
50    LL=XRES/100:AP=0:CO=0:IB=0:C=0
60    PEN=1
70    CS=COS(CF*PS):SS=SIN(CF*PS)
80    CP=COS(CF*PH):SP=SIN(CF*PH)
100   CT=COS(CF*TH):ST=SIN(CF*TH)
110   J=0:L=LL
120   FOR I=1 TO 5
130   XX(I)=.15*XRES*COS(CF*J)
140   YY(I)=.15*XRES*SIN(CF*J)
150   J=J+72
160   NEXT I
170   PEN=0
180   XX(6)=XX(1):YY(6)=YY(1)
190   A=XX(5):B=YY(5):C=0
200   GOSUB 1000:GOSUB PLOT
210   PEN=5
220   A=XX(1):B=YY(1)
230   GOSUB 1000:GOSUB PLOT
240   FOR I=1 TO 5
250   PEN=I
260   A=XX(i):B=YY(i)
270   GOSUB 1000:GOSUB PLOT
280   R=((XX(I+1)-XX(I))^2+(YY(I+1)-YY(I))^2)^.5
290   QQ=(XX(I+1)-XX(I))*L/R
300   WW=(YY(I+1)-YY(I))*L/R
310   XX(I)=XX(I)+QQ
320   YY(I)=YY(I)+WW
330   NEXT I
340   XX(6)=XX(1):YY(6)=YY(1)
350   L=L*.97
360   IF R<120 THEN 380
370   GOTO 240
380   PH=243
390   AP=-243*(1+COS(63*CF))
400   CO=-243*SIN(63*CF)
410   IF IB=1 THEN PS=PS+ 72
420   IB=1
430   IF PS=360 THEN 900
440   GOTO 70
900   IF Q=XRES/4 THEN 910 ELSE END
910   Q=Q+XRES/2
920   X=-X
930   TH=0:PH=0:PS=0
940   GOTO 50
1000  A1=A*CP-C*SP
1010  C2=A1*SP+C *CP
1020  A=A1:B1=B
1030  B=B1*CT-C2*ST
1040  C=C2*CT+B1*ST
1050  A=A+AP:C=C+CO
1060  A4=A*CS-B*SS
1070  B4=A*SS+B *CS
1080  A=A4:B=B4
1090  CZ=C/(Z-C)
1100  M=A+(A-X)*CZ+Q
1110  N=B+(B-Y)*CZ+W
1120  RETURN
```



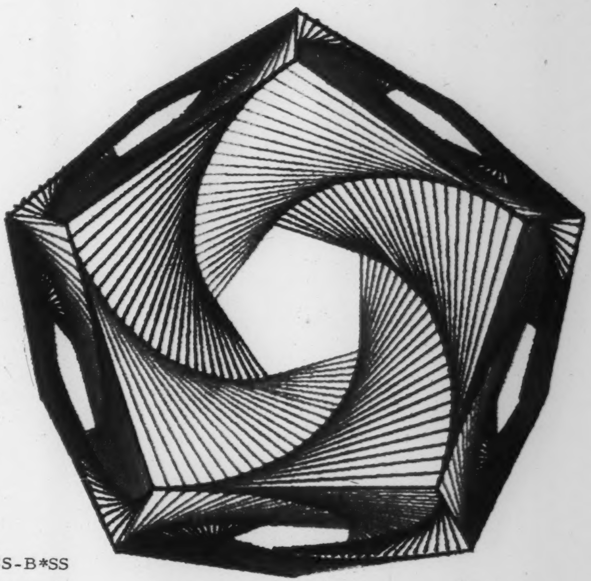


Figure 9. This dodecahedron was created using rotation and translation of a single pentagon.

line you have drawn covers both "sides" of the strip. Since you didn't go over an edge, the strip really must have only one side.

Listing 4 contains the lines for the mobius strip shown in Figure 6. Lines 100 230 draw in the colored bars which form the surface of the strip. The edge is drawn by lines 250–320. Notice that the rotation of the strip, generated by the second term of the variable A and by C, contains the factor 1/2. This causes the 180° twist in the strip.

"String Art" was part of the pop art fad of a couple of decades ago. A string art creation is made by nailing a set of pegs in a board along a predetermined set of lines and then running a length of string from peg to peg in a pattern. Listing 5 generates 3-D stereo string art (Figure 7). These patterns are also known to electronics engineers as Lissajous figures, which are created by using harmonics of sine waves to generate the a and b object coordinates. Of course, we will throw in a component in the Z direction for depth.

To make different figures, try varying the STEP size in line 100 and the arguments of the trig functions in lines 110–130.

Figure 8 illustrates the possibility of creating symmetrical patterns by drawing a segment and then rotating it sufficient times about the Z axis to make a circular pattern. Listing 6 creates the figures shown in Figure 8. The original figure is drawn in a 60° angular segment. This is rotated by 60° five times to complete the drawing.

The dodecahedron of Figure 9 extends this concept to translation as well as rotation. It consists of a single pentagon which is rotated and translated five times to make the top half of the figure. The bottom six sides are not drawn, giving the illusion of hidden line removal. Part 2 of this series will include a detailed consideration of hidden line removal.

As with most string art, the object appears to contain curved lines, even though only straight lines are used in drawing it. Because the generation of the dodecahedron requires rotation, translation, and then another rotation, extensive modification of Listing 1 is necessary. Listing 7 contains the *entire* program for generating the dodecahedron.

Finally, I leave you with the blown dandelion of Figure 10. The RND (random) function was used in generating the coordinates for the fuzz, so this one comes out different each time it is drawn. The one you see here will probably never be duplicated. If you want a listing for this program, you must first blow off the rest of the fuzz, then send me an SASE for the listing. So go ahead. Make a wish and blow. Then make some nice pictures of your own. And watch out for those bats at the movies. See you next month when we will discuss the creation of mesh plots of functions of two variables and hidden line removal. □

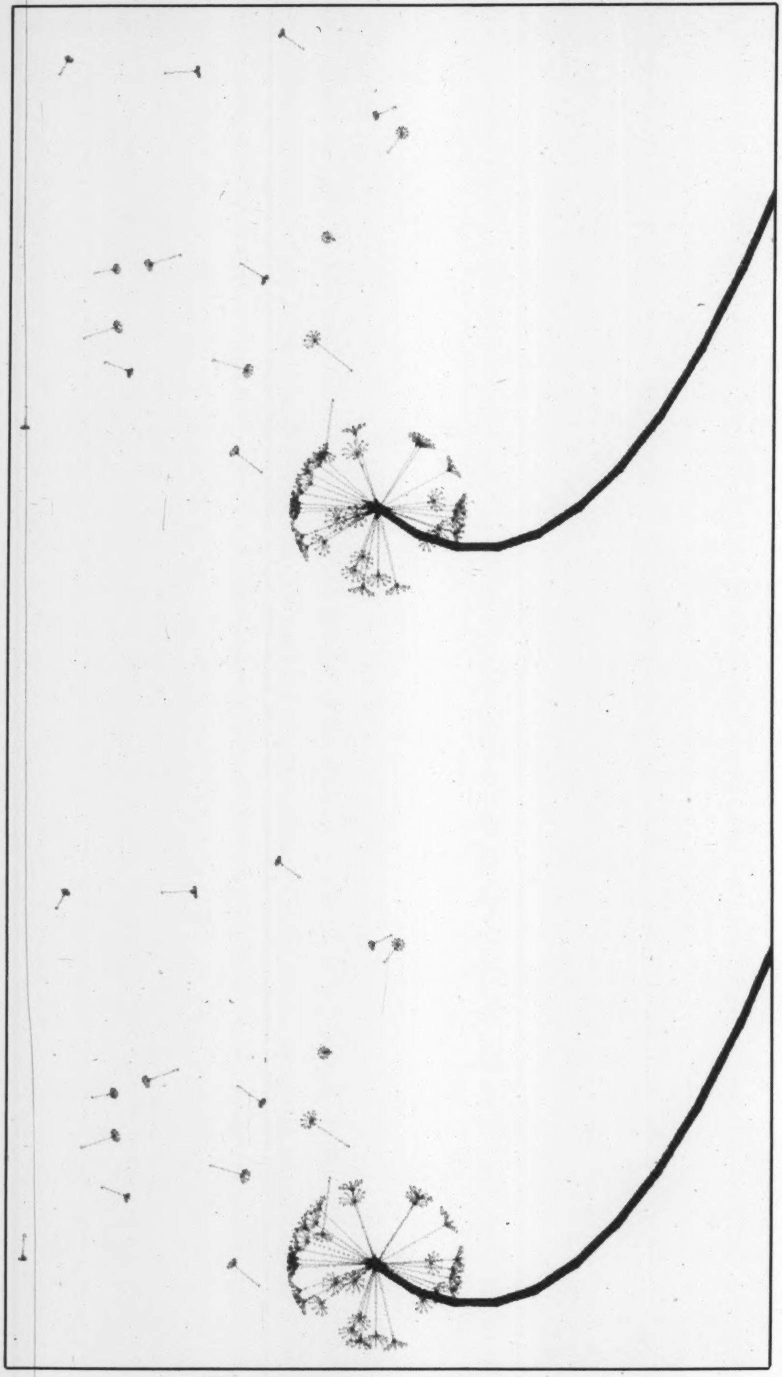


Figure 10. Dandelion with airborne fuzz.

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- Z80 Development Package
- ZSID

Telecommunications:
- ASCOM
- BSTAM
- BSTMS
- eZmail
- MicroLink-80
- RBTE-80

Languages:
- ALGOL-60
- APL/V80
- BASIC Compiler
- BASIC-80
- baZic II
- BD Software C Compiler
- CBASIC-2
- CIS COBOL (Standard)
- COBOL-80
- FORTRAN-80
- KBASIC
- JRT Pascal
- muLISP/muSTAR
- Nevada COBOL
- Pascal/M
- Pascal/MT
- Pascal/M +
- Pascal/Z
- PL/I-80
- Precision BASIC
- STIFF UPPER LISP
- S-BASIC
- Timin FORTH
- Tiny-C
- Tiny-C TWO
- UCSD Pascal
- Whitesmiths' C Compiler
- XYBASIC

Language and Applications Tools:
- BASIC Utility Disk
- DataStar
- FABS
- FABS II
- Forms 2 for CIS COBOL
- MAG/sam3,4
- MAG/sort
- M/SORT for COBOL 80
- Programmer's Apprentice
- PSORT
- QSORT
- STRING/80
- STRING BIT
- SuperSort
- ULTRASORT II
- VISAM

Word Processing Systems and Aids:
- Benchmark
- DocuMate/Plus
- Letteright
- MagicPrint
- Magic Wand
- Math★
- MicroSpell
- SMARTKEY
- Spellguard
- TEX
- Textwriter III
- WordIndex
- WordStar
- WordStar French
- WordStar Customization Notes

Data Management Systems:
- CONDOR
- dBASE II
- Formula
- HDBS
- Hoe
- MAG/base1,2,3
- MDBS
- MicroSEED
- T.I.M. III

General Purpose Applications:
- CBS
- CBS Label Option Pak
- Selector III-C2
- Selector IV

Mailing List Systems:
- Benchmark Mailing List
- Mailing Address
- MailMerge for WordStar
- NAD
- Postmaster

Financial Accounting Packages:
- BOSS Financial Accounting System
- Financial Pkgs. (PTree)
- Financial Pkgs. (SSG)
- General Ledger Acctng (Univair)
- GLector

Numerical Problem-Solving Tools:
- Analyst
- fpl
- Microstat
- muSIMP/muMATH
- PLAN80
- SigmaCalc
- Statpak
- T/MAKER II

Professional And Office Aids:
- Apartment Mngmnt (Cornwall)
- Datebook
- Dental Mngmnt (Univair)
- Dental Mngmnt-Family (Univair)
- GrafTalk
- Insurance Agency Mngmnt
- Legal Time Acctng (Univair)
- Medical Mngmnt (Univair)
- Medical Mngmnt-Family (Univair)
- PAS 3 Medical
- PAS 3 Dental
- Professional Time Acctng (PTA)
- Property Mngmnt Pkg. (Am. Soft.)
- Property Management (PTree)
- Sales Pro
- Wiremaster

Lifeboat After Hours
- Backgammon/Gomoku

Educational Tools
- Torricelli Author
- Torricelli Studio

Books and Periodicals
- APL—An Interactive Approach
- Accounts Payable and Accounts Receivable-CBASIC
- CBASIC User Guide
- The Computer Glossary
- The CP/M Handbook (with MP/M)
- The C Programming Language
- Crash Course in Microcomputing
- Devil's DP Dictionary
- Discover FORTH
- DON'T (Or How To Care For Your Computer)
- 8080/Z80 Assembly Language Techniques For Improved Programming
- Executive Computing
- Fifty BASIC Exercises
- General Ledger-CBASIC
- Introduction to Pascal
- Lifelines/The Software Magazine
- Pascal User Manual and Report
- The Pascal Handbook
- The Pascal Primer
- Payroll with Cost Accounting —CBASIC
- Structured Microprocessor Programming
- A User Guide To The UNIX System
- Using CP/M—A Self-Teaching Guide

Hardware and Accessories
- DC Data Cartridges
- Diskette Drive Head Cleaning Kits
- Flippy Disk Kit
- Floppy Saver
- Smartmodem
- Vari Clean Cleaning Kit

Disk Operating Systems
- BRIDOS
- CP/M-80
- MP/M
- SB-80
- APPLI-CARD
- Softcard

Hard Disk Integration Modules

Media & Formats for 8-AND 16-Bit Microcomputers

This list of available formats is subject to change without notice. If you do not see your computer listed or are uncertain, call to confirm the format code for any particular equipment.

A.B. Dick	M8
ADDS Multivision	RT
AES Super Plus IV	Q4
ALSPA 8″	A1
Altair 8800	B1
Altos	A1
Apple CP/M-80 13 Sector	RG
Apple CP/M-80 16 Sector	RR
Archives 1	SG
AVL Eagle I	RB
AVL Eagle II	ST
BASF System 7100	RD
Blackhawk Micropolis Mod II	Q2
BMC iF-800	SR
Cado	A1
California Computer Sys 8″	A1
CDS Versatile 3B	Q1
CDS Versatile 4	Q2
Columbia Data Products 8″	A1
Columbia Data Products 5¼″	S4
Commodore CBM/PET + SSE Box + 8050	C2
Commodore CBM/PET w/Madison Z-RAM + 8050	C4
COMPAL-80	Q2
Compucorp 655	Q7
Compucorp 685	Q6
Computer Ops N.C. HQ	S2
Control Data 110	A1
CPT 8000	A1
Cromemco System 3	A1
Cromemco System 2 SD/SS	R6
Cromemco System 2 DD/SS	RX
Cromenco System 2 DD/DS	RY
CSSN Backup	T1
Datapoint 1550/2150 DD/SS	AA
Datapoint 1550/2150 DD/DS	AB
Datavue DU 80-222	M7
DEC VT 18 X	SD
Delta Systems	A1
Digi-Log Microterm II	RD
Digi-Log Sys. 1000/1500/2000	RD
Direct OA1000	M2
DTC Micro 210A	SC
Durango F-85	RL
Dynabyte DB8/2	R1
Dynabyte DB8/4	A1
Exidy Sorcerer + LB CP/M-80 5¼″	Q2
Exidy Sorcerer + Exidy CP/M-80 5¼″	RW
Exidy Sorcerer + Exidy CP/M-80 8″	A1
EXO	A1
Exxon 510/520	Q5
Findex	P6
Godbout	E1
Heath H8 + H47	A1
Heath H89 + Magnolia CP/M-80	P7
Heath H89 + Heath CP/M-80	P7
Helios II	B2
Heurikon MLZ, SS	SN
Heurikon MLZ, DS	SO
Heuristics HCC Spectrum	A1
Hewlett-Packard-87	SB
Hewlett-Packard 125, 5¼″	SB
Hewlett-Packard 125, 8″	A1
IBEX 7100	RQ
IBM Personal Computer	G1
ICL Personal Computer	RE
iCOM 2411 Micro Floppy	R3
iCOM 3712	A1
iCOM 3812	A1
iCOM 4511 Cartr. CP/M v.1.4	D1
iCOM 4511 Cartr. CP/M v.2.x	D2
IMSAI VDP-40/VDP-42	R4
IMSAI VDP-44	R5
IMSAI VDP-80	A1
Industrial Microsystems 5000	RA
Industrial Microsystems 8000	A1
Intel iPDS	M6
Intel MDS SD	A1
Intersil Development Sys	A1
Inter Systems Ithaca 800	A1
Intertec Superbrain DOS 0.5-2.x	RJ
Intertec Superbrain DOS 3.x	RK
Intertec Superbrain QD	RS
ISC Intecolor 8063/8360/8963	A1
Lanier EZ-1	M3
Lanier Super	Q4
Lexitron VT 1303 DS/DD	S8
Lexor Alphasprint Model S1	S1
Lexor Lexoriter	S1
Meca Delta-1 5¼″	P6
MICOM 2001	B3
MICOM 2001E	B4
MICOM 3003	M1
Micromation	A1
MicroMega 85	SC
Micropolis Mod 1	Q1
Micropolis Mod II	Q2
MITS 3200-3202	B1
Monroe OC 8820, DD/SS	SW
Morrow Discus	A1
Mostek	A1
MSD 5¼″	RC
MULTI-TECH-I	Q2
MULTI-TECH-II	Q2
Nascom (Gemini drives)	R3
Nascom II with Lucas Drives	SL
National MSC 6600	A1
NCR 8140/9010	A1
NEC PC-8001	RV
Nicolet Logic Analyzer Model 764	SX
NNC-80/80W	A1
North Star SD	P1
North Star DD	P2
North Star QD	P3
Northern Telecom 503	SM
Nylac Micropolis Mod II	Q2
Ohio Scientific C3	A3
OKI iF-800 + MSA CP/M-80	SP
OKI iF-800 + OKI/LB CP/M-80	SR
Osborne-1	SA
Otrona Attache	MC
Pertec PCC 2000	A1
PET/CBM + SSE Bx + 8050	C2
PET/CBM w/Madison Z-RAM + 8050	C4
Philips P-2000	MA
Philips MICOM 2001 8″	B3
Philips MICOM 2001E	B4
Philips MICOM 3003	M1
Processor Technology Helios II	B2
Quasar QDP100	A1
Quay 500	RQ
Quay 520	RP
Quay 900	A1
RAIR DD	RE
RAIR SD	R9
Research Machines 5.¼″	RH
Research Machines 8″	A1
Sanco 7000 5″	RQ
Sanyo MBC 1000	SY
Sanyo MBC 2000	SS
Sanyo MBC 3000	A1
Seattle	E1
Sony	U1
SD Systems 5¼″	R3
SD Systems 8″	A1
Spacebyte	A1
Tarbell 8″	A1
TecMar	E1
TEI 5¼″	R3
TEI 8″	A1
Televideo DD/DS	S5
T.I.P. (Alloy Engineering, Inc.)	T3
Toshiba T200	SF
Toshiba T250	A1
Triumph Adler Alphatronic	SV
TRS Model I + Omikron 5¼″	RM
TRS Model 1 + FEC Freedom	RN
TRS-80 Model 1 + Shuffleboard	A1
TRS-80 Model II	A1
Vector MZ	Q2
Vector System 2800	A1
Vector System B/VIP	Q2
Vista V-80 5¼″ SD	R8
Vista V200 5 DD	P6
Wangwriter	SE
WORDPLEX	SZ
XEROX 820, 5¼″	S6
XEROX 820, 860 8″	A1
ZEDA 580	SH
Zenith Z89 + Magnolia CP/M-80	P7
Zenith Z89 + Zenith CP/M-80	P7
Zenith DD/SS	SK
Zenith DD/DS	SJ
Zilog MC 22-20/25/50	A1

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All Lifeboat (LB) 8-bit software requires SB-80 (or other CP/M-80 compatible disk operating system) unless otherwise stated.

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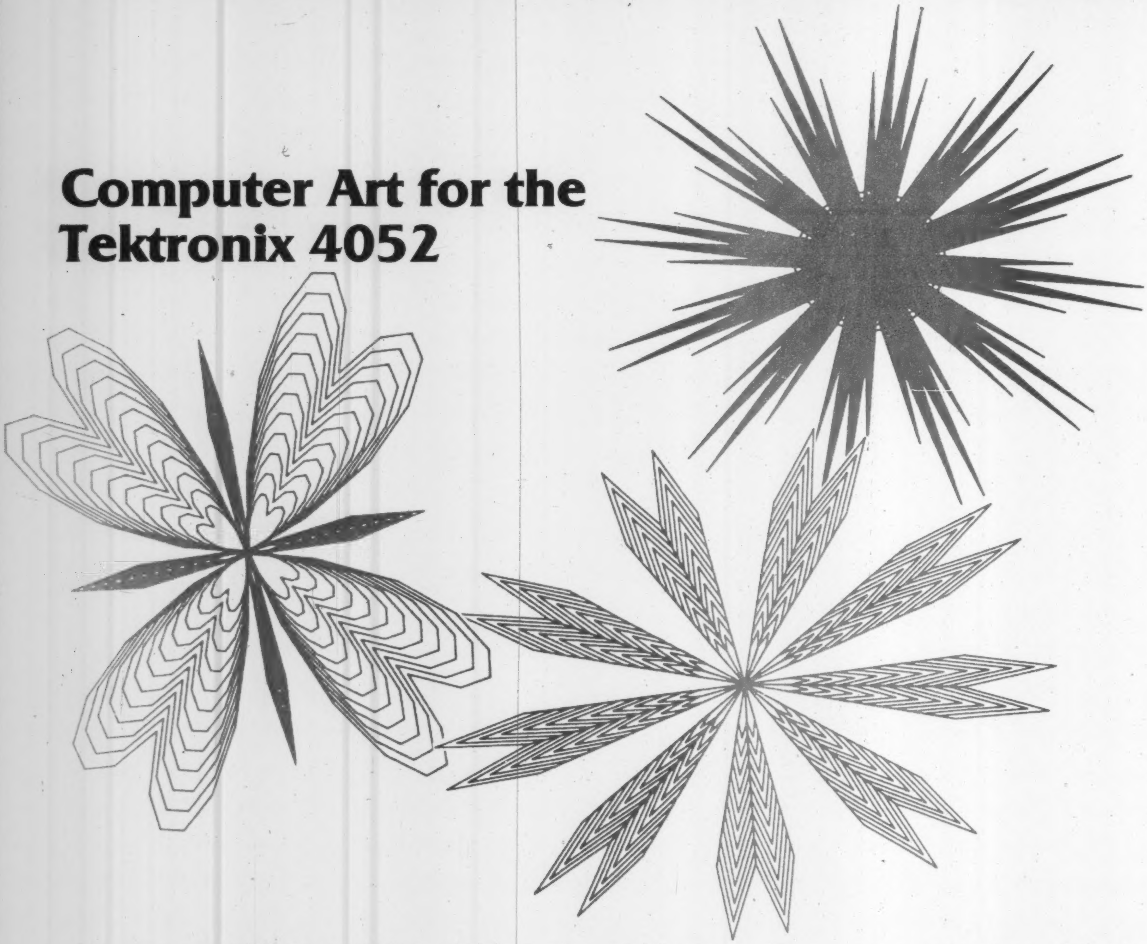
Computer Art for the Tektronix 4052



Joe Jacobson

A common motif in analytical computer art is the polar coordinate curve. This has the form R=f(A), where R is the radius, f is a mathematical function, and A is the angle. The angle parameter A is swept through some range of values, the radius R is calculated, and the computed polar coordinate points (R,A) are converted to rectangular coordinates and plotted.

The resulting curves frequently (but not always) exhibit angular symmetry; that is, they look the same after being rotated through a suitable angle.

Like many other computer artists, I had played with polar coordinate designs from time to time, but it seemed to me that the possibilities were limited with these curves. You generally ended up with designs like those in Figures 1 and 2, which are similar to the polar coordinate curves found in high school texts on analytic geometry.

It was with considerable interest that I became aware of an innovation in polar curve plotting by a fellow computer artist and engineering co-worker, Woodrow Europa. Woodrow repeatedly swept simple polar coordinate curves through the interval from 0 to 360 degrees, and incremented the radius by a fixed amount between sweeps. The result was similar to the design in Figure 3, and seemed more aesthetic than the patterns based on a single angular sweep.

Woodrow's program was written for the Hewlett-Packard 9825B desktop computer, which uses a language (HPL) that is somewhat different from standard Basic. I transcribed his algorithm into Tektronix 4052 Basic and used it to generate designs of the type shown in Figures 3 and 4.

Woodrow's algorithm used the polar coordinate function R = B*(1-SIN(L*A)), where L is a constant selected by the user, and B is increased for each successive angular sweep. Curves of this type, which incorporate trigonometric functions, display a high degree of angular symmetry and consist of lobes that look somewhat like flower petals (as in Figure 4).

Traditionally, small integral values of L are used; L = 3 in Figure 3 and L = 8 in Figure 4. It was generally assumed that increasing L would just increase the number of petals in the daisy-like design. This is what would be expected on purely mathematical grounds.

After a short while I stopped using this algorithm, because the variety of different pictures that could be made still seemed very limited. It sat in a tape file for a couple of years before I realized that I could, after all, create some unusual effects by using larger values of L.

This is the case because computer science is a bit different from pure

---

Joe Jacobson, 675 E. Street Road., Apt. 1009, Warminster, PA 18974.

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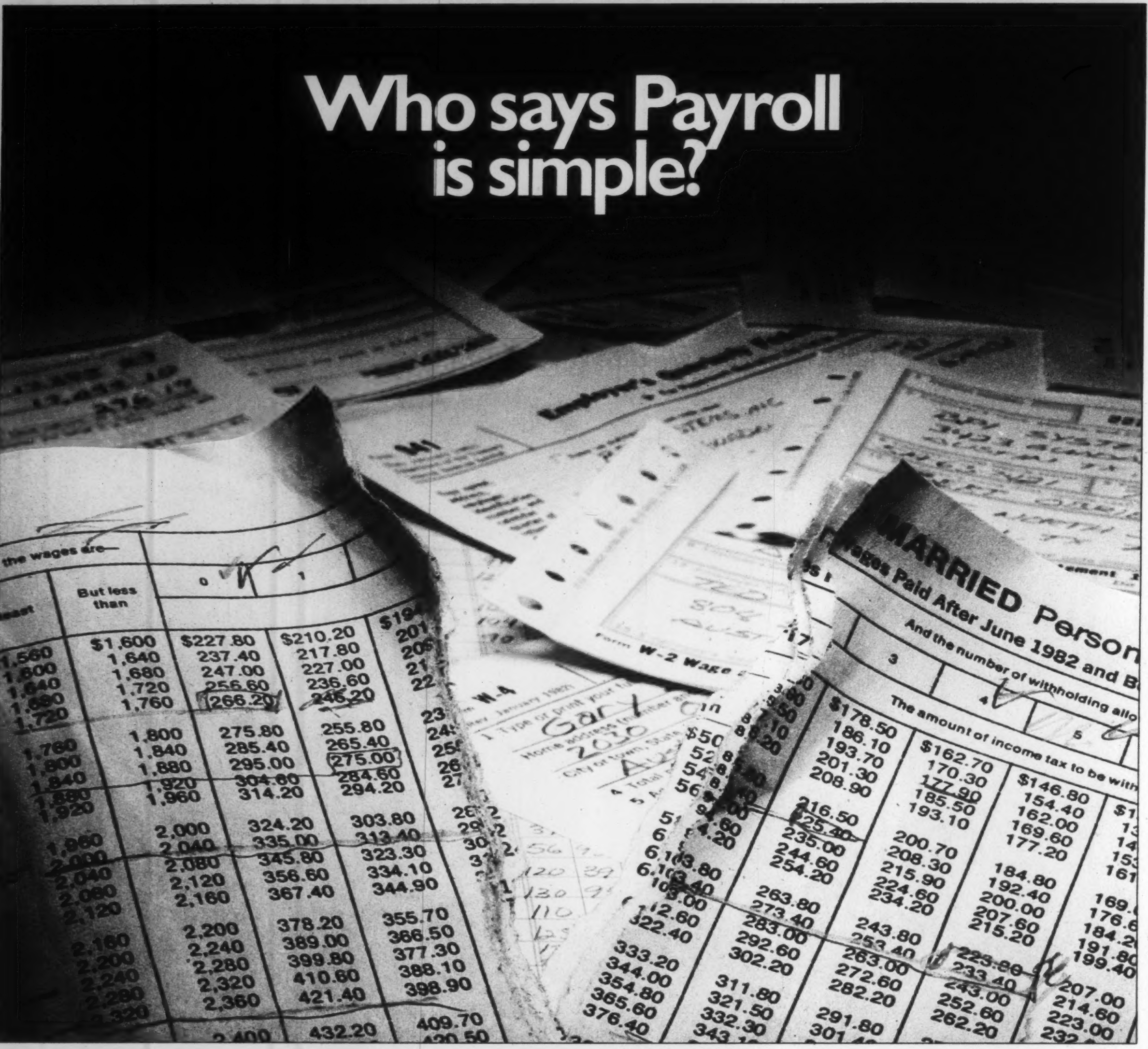

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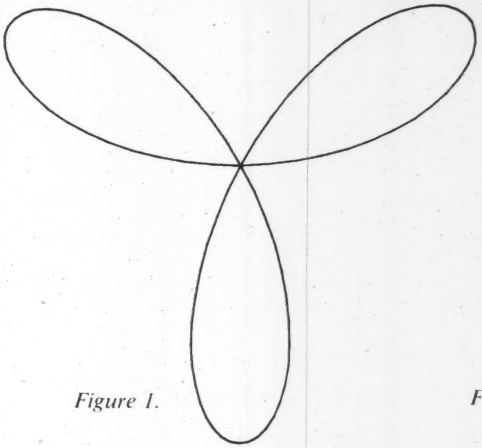

Figure 1.

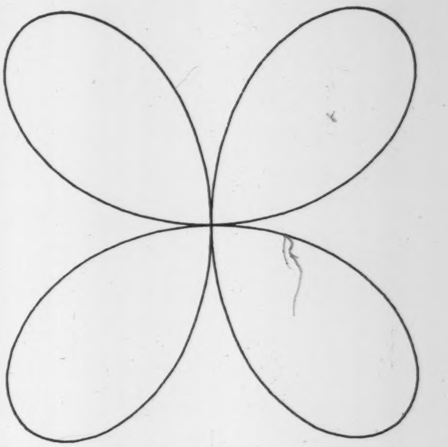

Figure 2.

mathematics. In particular, computers use finite increments and intervals. If the increment in the angle A were made smaller and smaller as higher values of L were tried, a simple daisy pattern would indeed result.

But if the increment in A was fixed at some reasonably large value, such as 5 degrees, only selected points on the daisy pattern would be computed; when these points were connected by straight line segments through use of vector graphics routines, new and novel patterns could be created. In fact, successive computed points could jump around on the background daisy pattern in a rather wild fashion.

A sample pattern is shown in Figure 5. This design was made using L = 16 in Woodrow Europa's algorithm. The angular increment was 5 degrees.

I then generalized Woodrow's algorithm in two ways. First, I incorporated five additional, carefully chosen polar coordinate functions, which are embedded in subroutines and selectable by inputting a value for the parameter N from the keyboard.

Second, I made provision for inputting the amount (D) by which the radius B is increased for successive angular sweeps; and the amount (G) by which the angle A is incremented during an angular sweep.

In addition, I installed an option, selectable through the parameter T1, that enables the user to get a list of the values of parameters N, L, D, and G at the bottom of the picture. In this way a pleasing design can readily be re-created at a future date without straining one's memory.

I call the resulting program Sinusoidal Loop Program No. 1, and it can be used to create a large number of varied and striking patterns. Some of these are reproduced here (Figures 6-10).

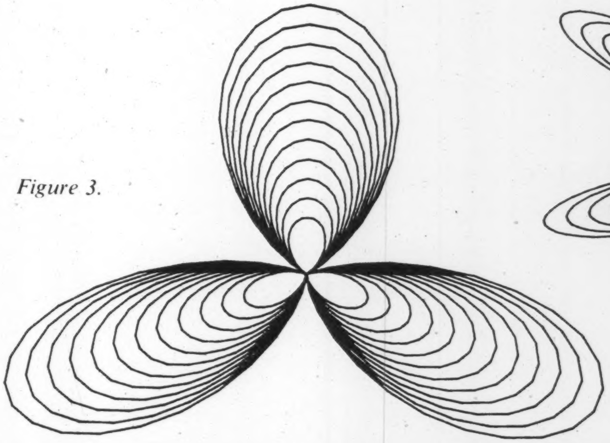

Figure 3.

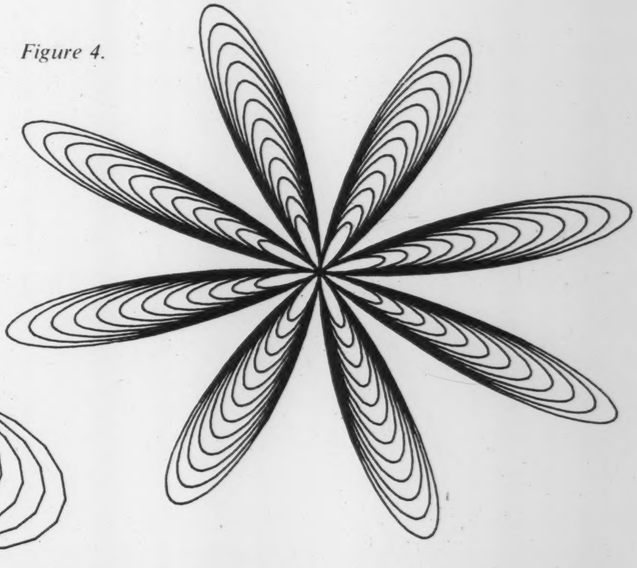

Figure 4.

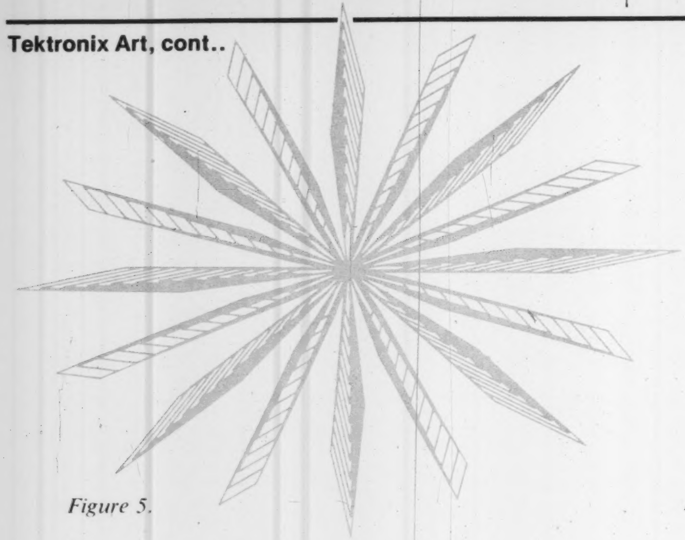

Figure 5.

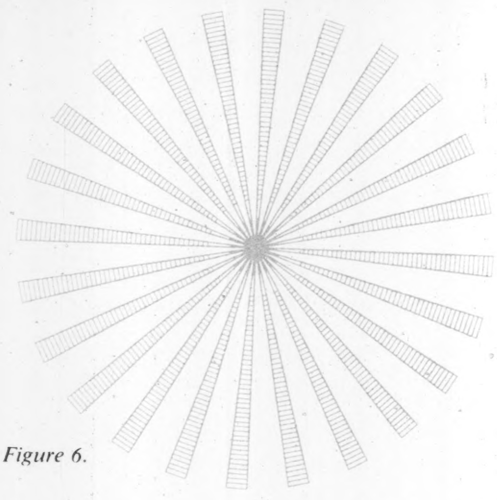

Figure 6.

The Program

The program is easy to use. It prompts the user to enter values for N, L, D, and G from the keyboard. When it asks for a value for T1, enter a 1. The picture will then be plotted (it takes 10 to 20 seconds on a Tektronix 4052) and the parameter values listed at the bottom.

Then press the HOME/PAGE button to clear the screen and hit the RETURN key; the picture will be plotted again, but this time without the parameter values. (Alternatively, if you don't want a parameter value list at all, enter a 2 when the program asks for T1, and you will get a "clean" plot the first time.) Type RUN to execute the program again for the next picture.

Table 1 lists the ranges of input parameter values that I have found to give good results with this program. However, some values outside these intervals could conceivably make good pictures too. The patterns tend to repeat for L values larger than about 60 (with G = 5 degrees). The parameter values don't have to be integers; I have had good results with decimal fractions like L = 17.2 and L = 29.2.

In fact, if you change the L value by as little as ± 0.1, you may get an entirely different picture. This, again, is something that was not realized

```
100 REM SINUSOIDAL LOOP PROGRAM NO. 1
110 PAGE
120 PRINT "ENTER N TO SELECT SUBROUTINE."
130 PRINT "N MUST BE 1,2,3,4,5 OR 6."
140 INPUT N
150 PRINT "ENTER L TO GENERATE A PARTICULAR PICTURE."
160 INPUT L
170 PRINT "ENTER D TO ADJUST SPACING"
180 PRINT "BETWEEN ANGULAR SWEEPS."
190 PRINT "SELECT A VALUE BETWEEN 30 AND 50 FOR D."
200 INPUT D
210 PRINT "ENTER G TO ADJUST ANGULAR INCREMENT."
220 INPUT G
230 PRINT "ENTER T1"
240 INPUT T1
250 PAGE
260 SET DEGREES
270 IF T1=2 THEN 300
280 VIEWPORT 22,108,14,100
290 GO TO 310
300 VIEWPORT 15,115,0,100
310 FOR B=0 TO 360 STEP D
320 FOR A=0 TO 360 STEP G
330 IF N>2 THEN 390
340 IF N=1 THEN 370
350 GOSUB 540
360 GO TO 740
370 GOSUB 500
380 GO TO 740
390 IF N>4 THEN 450
400 IF N=3 THEN 430
410 GOSUB 620
420 GO TO 740
430 GOSUB 580
440 GO TO 740
450 IF N=5 THEN 480
460 GOSUB 700
470 GO TO 740
480 GOSUB 660
490 GO TO 740
500 REM FIRST SUBROUTINE (N=1)
510 WINDOW -500,500,-500,500
520 R=B*(SIN(L*A)+COS(L*A))
530 RETURN
540 REM SECOND SUBROUTINE (N=2)
550 WINDOW -750,750,-750,750
560 R=B*(COS(L*A)-ABS(SIN(L*A)))
570 RETURN
580 REM THIRD SUBROUTINE (N=3)
590 WINDOW -500,500,-500,500
600 R=B*ABS(SIN(L*A))
610 RETURN
620 REM FOURTH SUBROUTINE (N=4)
630 WINDOW -1000,1000,-1000,1000
640 R=B*(1-SIN(L*A))
650 RETURN
660 REM FIFTH SUBROUTINE (N=5)
670 WINDOW -500,500,-500,500
680 R=B*ABS(SIN(L*A)+COS(L*A))
690 RETURN
700 REM SIXTH SUBROUTINE (N=6)
710 WINDOW -500,500,-500,500
720 R=B*(1-ABS(SIN(L*A)))
730 RETURN
740 X=R*COS(A)
750 Y=R*SIN(A)
760 IF A>0 THEN 790
770 MOVE X,Y
780 GO TO 800
790 DRAW X,Y
800 NEXT A
810 NEXT B
820 IF T1=1 THEN 840
830 END
840 WINDOW 0.130,0,100
850 VIEWPORT 0,130,0,100
860 MOVE 0,10
870 PRINT "   SINUSOIDAL LOOP PROGRAM NO. 1 PARAMETERS"
880 MOVE 0.5
890 PRINT "(N,L,D,G) = (";N;",";L;",";D;",";G;")"
900 INPUT J$
910 T1=2
920 GO TO 250
```

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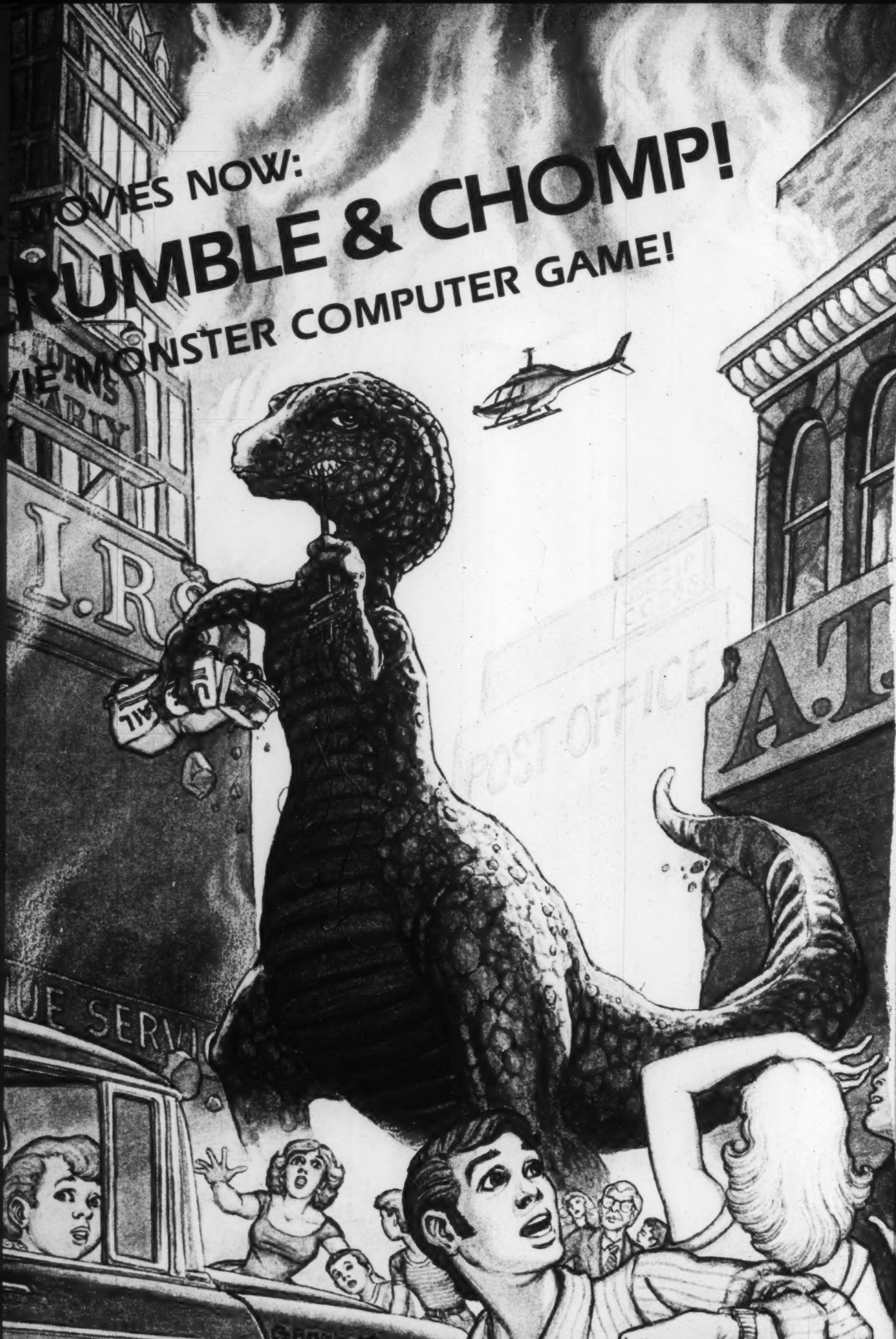

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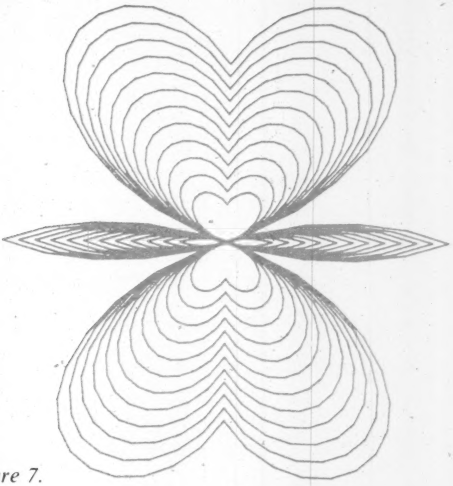


Figure 7.

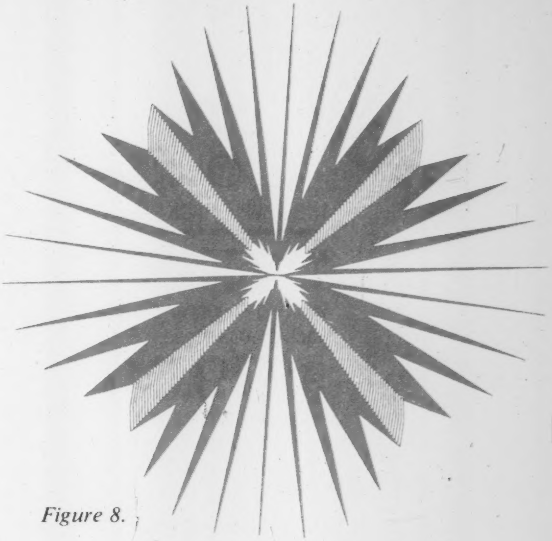


Figure 8.

Table I. Suggested Parameter Values.

Parameter	Range of Values	
	From	To
N*	1	6
L	6	60
D	30	50
G	5	15
T1**	1	2

*N must be 1,2,3,4,5, or 6.
**T1 must be 1 or 2.

historically. Similarly, small changes in the angular increment, G, can have a big effect.

Sinusoidal Loop Program No. 1 is the first of several recent computer programs I have written using polar coordinate functions; some of the others are further generalizations of Woodrow Europa's algorithm and some are completely new. They will all appear in *Creative Computing* over the next few months.

In order to use these programs you will need access to a Tektronix 4050 series terminal, which is used here as a stand-alone microcomputer, or some other system having extremely high CRT screen resolution. (Unfortunately, the vast majority of home computers do not have the necessary screen resolution. However, if you have a good mechanical X-Y plotter, that will do nicely.)

The programs generally take up about 6K of memory and use vector graphics. They are written in Basic, but the graphics commands (MOVE, DRAW, WINDOW, and VIEWPOINT) are machine specific. You will have to adapt the programs to your own graphics system.

Even if you don't have access to a suitable computer, I hope you will find the algorithms interesting (a complete source listing will accompany each article) and that you enjoy the sample output designs that will be reproduced with each listing. ☐

Figure 9.

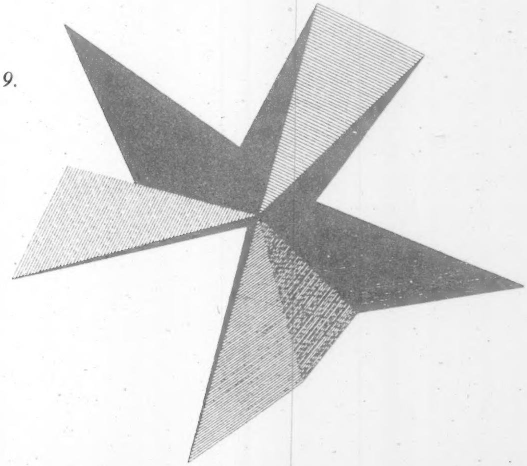
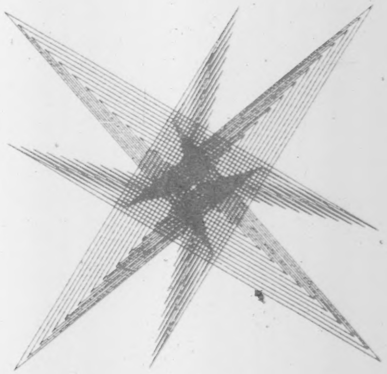


Figure 10.



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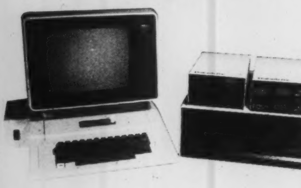

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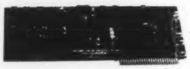

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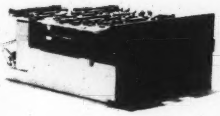

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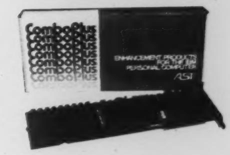

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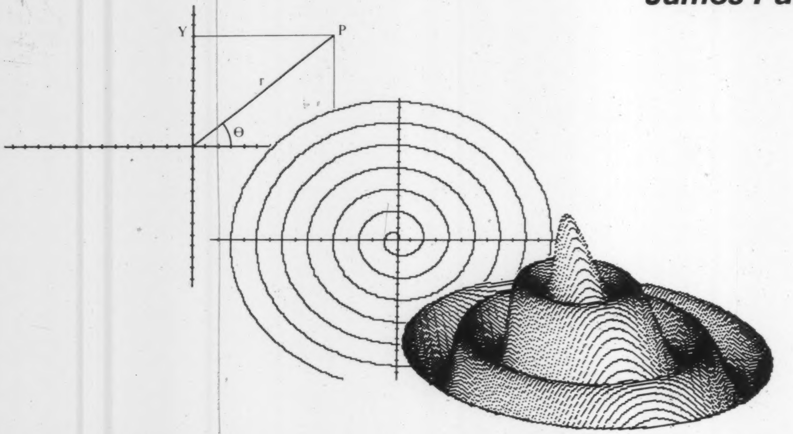
Three Ways of Looking At A Function

James Fuller



Anyone with scientific or technical interests needs to have an intuitive feeling for the behavior of different kinds of mathematical functions, and the typical shapes of their plots. This is one of the barriers which keep many people from an enjoyment of science, preventing them from taking pleasure in what is, when you think about it, the art of our time.

It used to be that the only way to acquire such an easy familiarity was to sit down with a pencil and graph paper, heave a sigh, and start plotting points.

Even with a calculator this is slave labor. So while most people (the ones who paid attention in high school, anyway) can recognize simple linear, exponential, and quadratic plots and the garden-variety trigonometric functions, if they encounter an unlovely object such as

$$f(X) = \cos(4X) + (20/(X^2 + 3))$$

it's back to graph paper.

For anyone with a personal computer, however, this is no longer true. The computer will take over the dull, repetitive task of plotting points, and the user is free to pay attention only to what the function actually does. He is also encouraged to experiment with the effects of making minor or major changes in the formula, and to plot it in different coordinate systems.

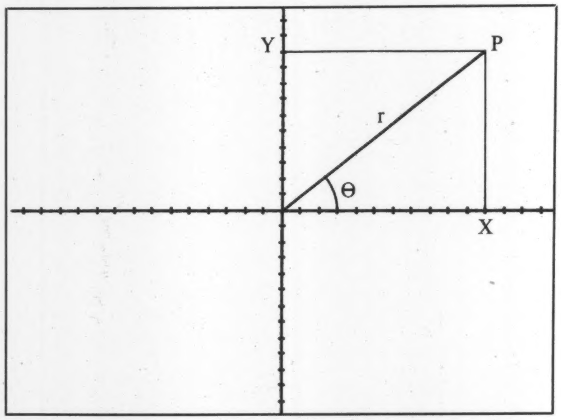
The Applesoft Basic program in Listing 1 can create three kinds of high-resolution plot of a given function. It can plot points in Cartesian or polar coordinates, or it can create a solid of revolution in three simulated dimensions.

Cartesian coordinates need no introduction and little discussion. They are used daily to plot everything from the third world birthrate to the speed with which Brand X aspirin enters the bloodstream.

When Descartes warped the future of Western thought by inventing the graph, this is what he invented. In this system a point is uniquely located in two dimensions by giving its coordinates on a horizontal and a vertical axis.

There is another way to locate a point uniquely in a plane, though this method is not in such common use. In the polar coordinate system we draw a line between the point of origin of the system and some other point of interest, and specify where that point is by giving its distance from the origin and the angle the line forms with the horizontal axis. Thus point p in Figure 1 can be located either by giving values for X and Y or by giving length r and angle θ (theta). The translation between the two systems involves the elementary trigonometric relations

Figure 1.



$$\sin\theta = Y/r \quad \text{and} \quad \cos\theta = X/r$$

or, rearranged,

$$X = r(\cos\theta) \quad \text{and} \quad Y = r(\sin\theta)$$

Polar coordinates are especially appropriate for graphing periodic functions such as sines and cosines. Complex combinations of simple periodic functions can result in

---

James P. H. Fuller, 2075 S. Lumpkin St., Athens, GA 30606.

some remarkably beautiful plots. Figure 2 is the polar plot of

$$f(X) = \cos(7 * \sin(2x))$$

A solid of revolution is created by rotating a two-dimensional figure about an axis to create a three-dimensional surface. A circle rotated about a line passing through its center creates a sphere, a right triangle rotated about one of its legs creates a cone, and so forth.

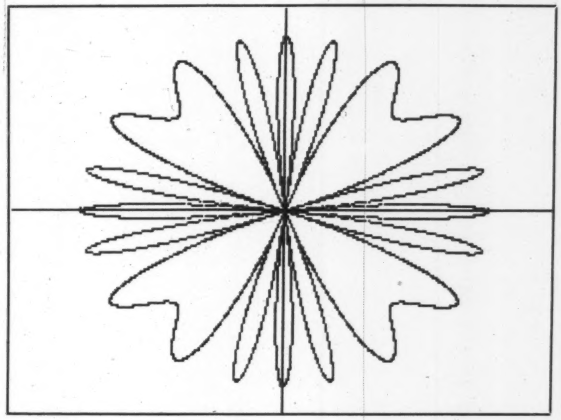


Figure 2.

The program presented here takes a function plotted in Cartesian coordinates and creates a solid of revolution by rotating it about the Y-axis. The program then displays the result on the screen in a way that gives a convincing illusion of a three-dimensional object. The viewer seems to be looking at it from above and somewhat to one side. Portions which he would not be able to see from this vantage point are eliminated.

Running The Program

To run the program, the user must first translate the function he wants to examine into Basic and type it into line 170:

```
170 DEF FN R(Q) = (user's formula, in terms of Q)
```

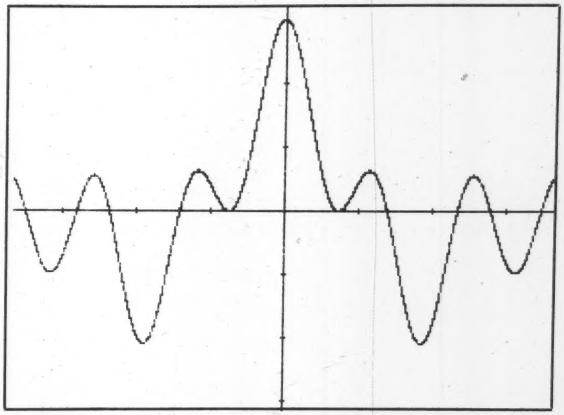


Figure 3.

The plotting routines can call it from this point whenever it is needed.

After the equation is entered and the program is started, a self-explanatory series of prompts appears, asking the user to choose a Cartesian, polar, or three-dimensional plot. If one of the first two is chosen, further questions appear asking about the function increment (how much distance between plotted points), whether the axes should be expanded or compressed, and whether the origin should be moved.

It is worth mentioning that whole number increments are not always best. For example, the function $f(X) = 1/(X-5)$ will give a divide-by-zero error where $X = 5$ if increment 1 is chosen. If increment 1.1 is chosen instead, X never lands precisely on 5 and the error is avoided.

Other prompts appear if the user asks for a three-dimensional plot. These plots have a habit of running off the top or bottom of the screen. If the user finds this is happening, he can enter a value which moves the plot up or down the screen, and another which expands or compresses it in the vertical direction.

Once all the questions are answered, the program assumes control and produces the desired plot in accordance with the instructions the user has given it.

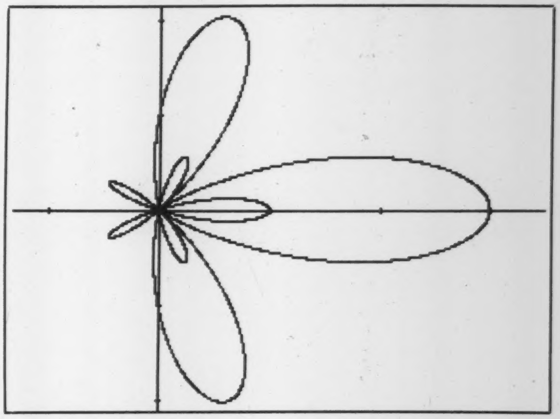


Figure 4.

Figures 3, 4, and 5 show the three types of plots the program can create of the function

$$f(X) = \cos(X) + \cos(2X) + \cos(5X).$$

Altering The Program

The program has another use besides examining the graphs of complicated equations. It can also create some very elegant graphics, which may be appreciated for their own sake. The slight alterations

```
690 FOR G = 0 to 36000 STEP I
    DEL 750, 760
770 IF G = 0 THEN HPLOT XX, YY
775 HPLOT TO XX, YY
```

will cause the computer to draw a line between each two consecutive points plotted in polar coordinates. This will have little effect if the points are close together (that is, if the function increment is small.) On the other hand, large increments often produce remarkable results. With an increment of 1, the function $f(X)=X/\pi$ (one version of Archimedes' spiral) produces the plot shown in Figure 6. The plots in Figures 7, 8, and 9 were produced by increments of 122, 145, and 88.5 respectively.

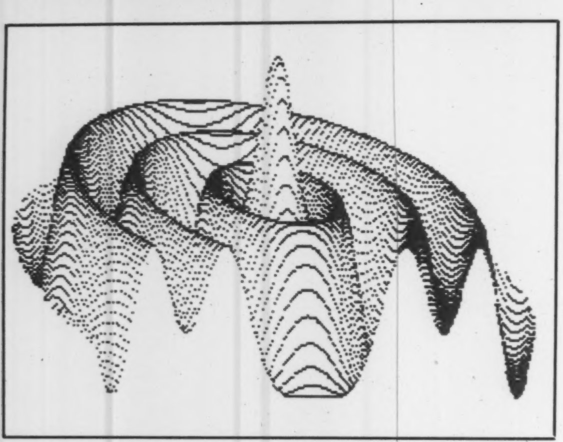


Figure 5.

As the program is printed here, the equation f(X)= .25 - sin (2X) gives the plot shown in Figure 10 (increment = 1, scale X = scale Y = 6). If line 660 is changed to read FOR G = 0 TO 3960 STEP I and the increment is set at 55, the result (Figure 11) resembles the calcium skeleton of some delicate, microscopic sea creature. The effect is particularly striking on a color monitor or TV.

Many other equations yield similarly beautiful results. (Try equations like f(X) = .5 - sin(X), with G stepping to 10700 by increment 143, or f(X) = cos(4X), with G stepping to 1800 by increment 25.) The knowledge that such rewards are waiting to be stumbled upon is enough to encourage endless experimentation.

The 3-D Plotting Module

The 3-D plotting module of the program also yields graphic rewards to the persistent heaper-upper of equation factors. Pleasing examples are shown in Figure 12

$$f(X) = \sqrt{|.5\ (16 - X^2)} + 1/(X + 4)$$

and Figure 13

$$f(X) = \cos(4X) + (20/(X^2 + 3))$$

— the ugly-duckling equation with which we began.

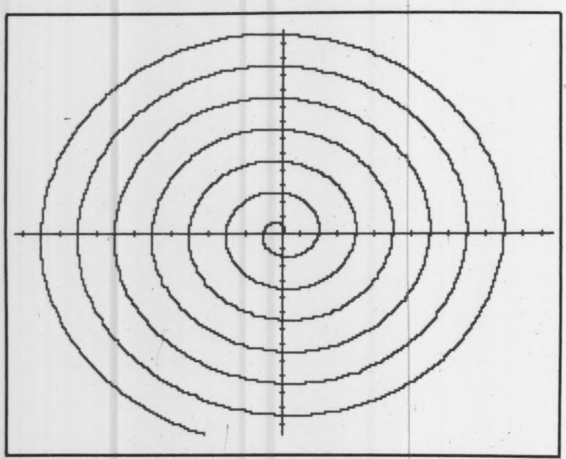


Figure 6.

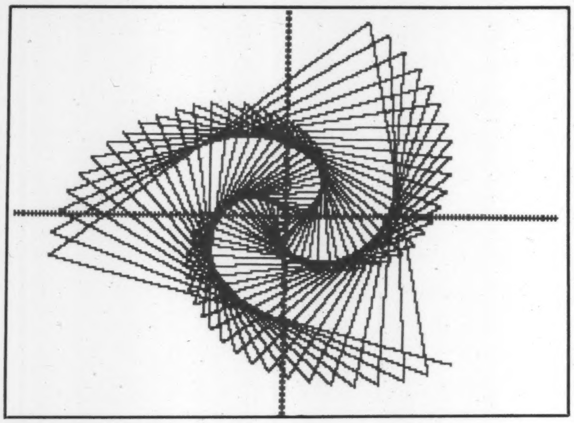


Figure 7.

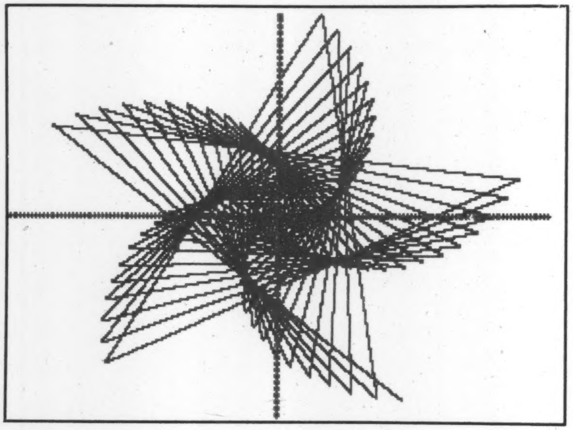


Figure 8.

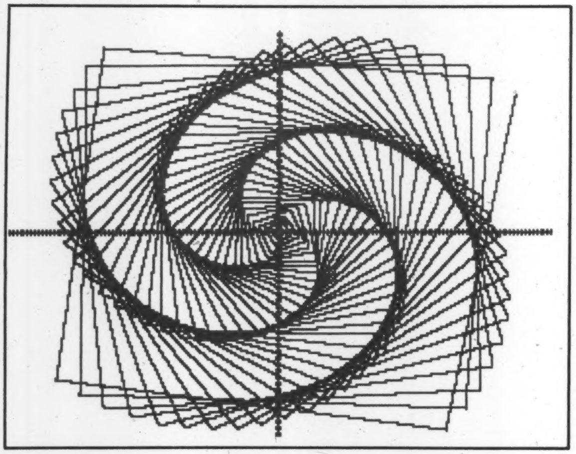


Figure 9.

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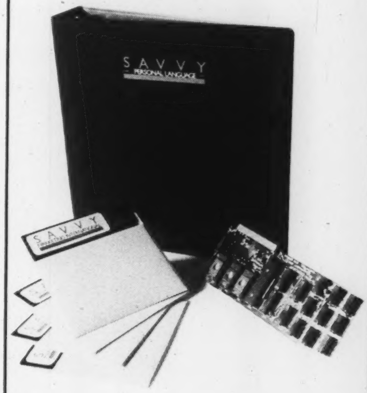

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In addition, "wrong" variables can be pulled out of their proper positions and plugged in to produce plots which clearly are not solids of revolution. Figure 14,

$$f(X) = \cos(2X) + \cos((X + BB)/16)$$

is such a plot.

The 3-D plotting module is slower than the others, simply because of the very much greater number of points which must be plotted to give a finished display. If the user is just searching for neat graphics, a cruder but faster trial version can be created by changing line 1430 to read FOR BB = -AA TO AA STEP 5.

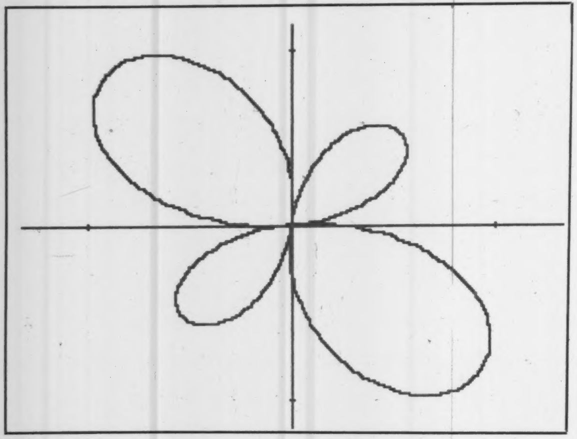

Figure 10.

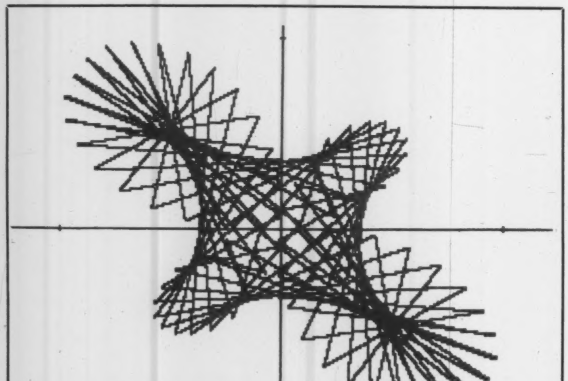

Figure 11.

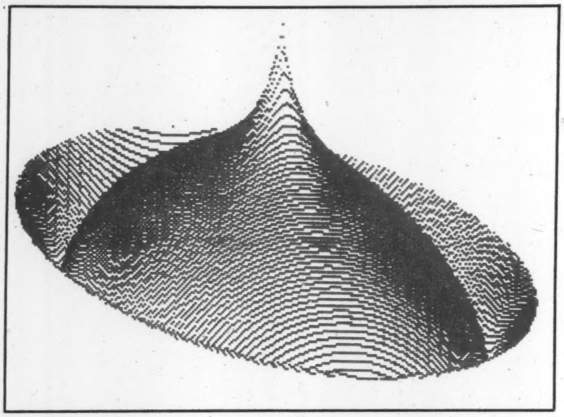

Figure 12.

The two short programs in Listings 2 and 3 are provided so that interesting plots can be saved and retrieved later rather than having to be recreated from scratch every time. After a plot is complete and the program has ended, clear the screen by typing TEXT and a carriage return. (Don't be alarmed—the picture has not been destroyed. It is still in memory although it no longer appears on the screen.) Then load and run the program SAVE PICTURE, which will save the plot on disk as a binary file under a name of your choice. The program DISPLAY PICTURE, similarly, will retrieve a saved plot from the disk and display it on the monitor screen.

The program needs only a few detailed comments. For the polar plot routine, the value G in line 690 is θ; r may be found using the Pythagorean theorem by taking X and Y, defined in lines 710 and 720, and setting $r = \sqrt{X^2 + Y^2}$. The result will be that r = f(T) = f(G/57.296), where f is the function the user has defined. (Note that T is in radian measure; this is accomplished in line 700. The Apple and many other small computers do their trigonometry in radians, not degrees.)

For the Cartesian plot module, the values of X and Y are found in lines 910 and 920. Other manipulations merely squeeze these values onto the Apple screen. "Invisible" points in three-dimensional plots are removed by lines 1610-1650, which change the plotting color to black, drop a black line from each plotted point to the bottom of the screen (thus erasing any previously plotted white points directly beneath it), and restore the plotting color to white again.

The program has been written for legibility and clarity, at a slight sacrifice in speed. Most lines contain only one

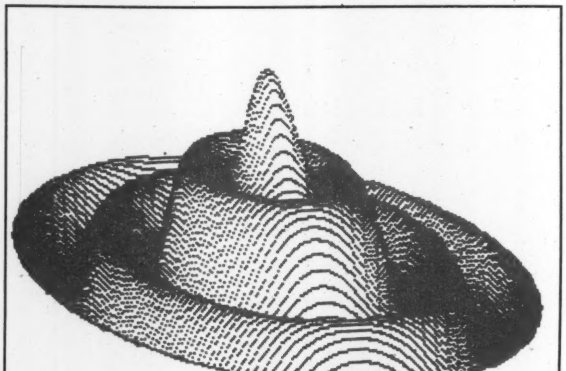

Figure 13.

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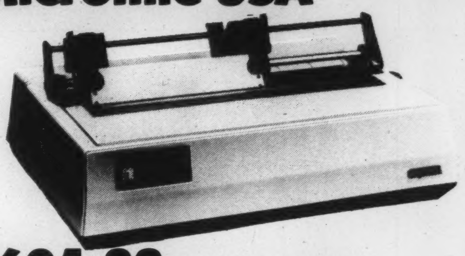

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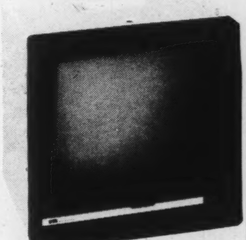

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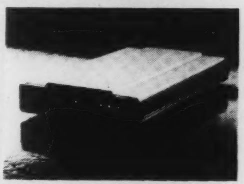

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CIRCLE 102 ON READER SERVICE CARD

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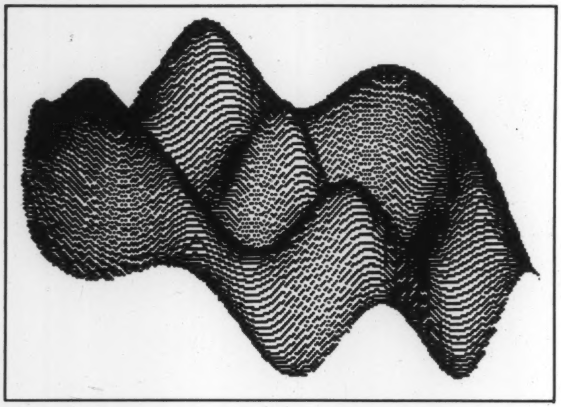

Figure 14.

program command. The FOR-NEXT loops which do the actual plotting have been indented to make their operation as understandable as possible, and to make it easy to translate them into other flavors of Basic. Of course, if you have an Applesoft compiler, you can compile the program into machine language, which will run much faster.

The program could be developed in several ways. It would be interesting and not difficult to include scaling routines which would allow plotting on logarithmic and semilog axes as well as on linear ones.

Using shape-table methods, a graphic character set could be defined and used to label the axes.

Finally, I have seen published explanations of ways to enter a function from the keyboard in response to a prompt, while the program is running—something Applesoft does not ordinarily allow. Inclusion of such a routine would make it unnecessary to change line 170 whenever you want to plot a new function. □

```
10   TEXT  : HOME
20   PRINT : PRINT : PRINT
30   PRINT   "THE CURRENT FUNCTION IS DEFINED AS:
40   PRINT : LIST 170
50   PRINT
60   PRINT   "DO YOU WISH
70   PRINT
80   PRINT   "  1) A CARTESIAN PLOT
90   PRINT   "  2) A POLAR PLOT
100  PRINT   "  3) A THREE-DIMENSIONAL PLOT
110  PRINT
120  PRINT : INPUT "ENTER 1, 2, OR 3. ";PL
130  PRINT
140  :
150  REM  ---------------------------------------------
160  :
170  DEF  FN R(Q) =  COS (Q) +  COS (2 * Q) +  COS (5 * Q)
180  :
190  REM  ---------------------------------------------
200  :
210  IF PL = 3 THEN 1010
220  IF PL < > 1 AND PL < > 2 AND PL < > 3 THEN 120
230  :
240  TEXT  : HOME
250  PRINT : PRINT
260  INPUT   "FUNCTION INCREMENT = ";I: PRINT
270  PRINT
280  PRINT   "TO EXPAND OR CONTRACT THE AXES, ENTER
290  PRINT   "A SCALING FACTOR.  FOR EXAMPLE,
300  PRINT   "TO DOUBLE THE SCALE, ENTER 2.
310  PRINT   "TO HALVE IT, ENTER .5.
320  PRINT
330  INPUT   "X-AXIS SCALING FACTOR = ";S1
340  PRINT
350  INPUT   "Y-AXIS SCALING FACTOR = ";S2
360  PRINT
```

```
370  PRINT   "TO MOVE THE ORIGIN LEFT OR RIGHT,
380  INPUT   "ENTER A NUMBER FROM -130 TO 130. ";C
390  PRINT
400  PRINT   "TO MOVE THE ORIGIN UP OR DOWN,
410  INPUT   "ENTER A NUMBER FROM -90 TO 90. ";D
420  :
430  HGR : POKE  -16302, 0
440  HCOLOR = 3
450     E = 96 + D
460     F = 139 + C
470        HPLOT F, 0 TO F, 191
480        HPLOT 0, E TO 278, E
490           FOR XR = F TO 278 STEP 19 * S1
500              HPLOT XR, E - 1 TO XR, E + 1: NEXT XR
510           FOR XL = F TO 0 STEP  -19 * S1
520              HPLOT XL, E - 1 TO XL, E + 1: NEXT XL
530           FOR YD = E TO 191 STEP 15 * S2
540              HPLOT F - 1, YD TO F + 1, YD: NEXT YD
550           FOR YU = E TO 0 STEP  -15 * S2
560              HPLOT F - 1, YU TO F + 1, YU: NEXT YU
570  :
580  IF PL = 1 THEN 820
590  IF PL = 2 THEN 610
600  :
610  REM  ---------------------------------------------
620  :
630  REM              ****************
640  REM              *              *
650  REM              *  POLAR PLOT  *
660  REM              *              *
670  REM              ****************
680  :
690  FOR G = 0 TO 360 STEP I
700     T = G / 57.29579
710        X =  FN R(T) *  COS (T)
720        Y =  FN R(T) *  SIN (T)
730           XX =   X * (19 * S1) + F
740           YY =  -Y * (15 * S2) + E
750              IF XX < 0 OR XX > 279 THEN 780
760              IF YY < 0 OR YY > 191 THEN 780
770           HPLOT XX, YY
780  NEXT G
790  :
800  STOP
810  :
820  REM  ---------------------------------------------
830  :
840  REM              ********************
850  REM              *                  *
860  REM              *  CARTESIAN PLOT  *
870  REM              *                  *
880  REM              ********************
890  :
900  FOR G = 0 TO 278 STEP I
910     X = (G - F) / (19 * S1)
920     Y =  FN R(X)
930        YY = E - (Y * 15 * S2)
940           IF YY < 0 OR YY > 191 THEN 960
950        HPLOT G,YY
960  NEXT G
970  :
980  STOP
990   :
1000  REM  --------------------------------------------
1010  :
1020  REM             ****************************
1030  REM             *                          *
1040  REM             *  THREE-DIMENSIONAL PLOT  *
1050  REM             *                          *
1060  REM             ****************************
1070  :
1080  HOME
1090  PRINT : PRINT
1100  PRINT   "TO EXPAND OR COMPRESS THE PLOT
1110  PRINT   "VERTICALLY, ENTER A NUMBER
1120  INPUT   "FROM -40 TO 40 (20 IS TYPICAL). ";N1
1130  PRINT : PRINT
1140  PRINT   "TO MOVE THE PLOT UP OR DOWN
1150  PRINT   "ON THE SCREEN, ENTER A NUMBER
1160  INPUT   "FROM -50 TO 150 (90 IS TYPICAL). ";N2
1170  :
1180  REM  --------------------------------------------
1190  :
1200  REM   CONSTANTS = A, B, C, D, E, F, G
1210  REM   FOR-NEXT VARIABLES = H, BB
1220  REM       DEPENDENT ON H = AA, BB
1230  REM       DEPENDENT ON H AND BB = CC, D1, DD
1240  REM   PLOTTING VARIABLES = X, X1, Y, Y1
1250  REM       DEPENDENT ON BB AND H = X, X1
1260  REM       DEPENDENT ON DD AND H = Y, Y1
1270  :
1280            A = 144
1290            B = 2.25
1300            C = N1
1310            D = .0327
1320            E = 160
```

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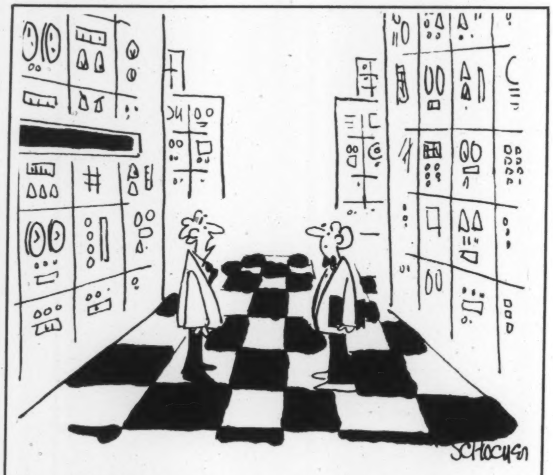
```
1330              F = N2
1340              G = 199
1350  :
1360  REM  ------------------------------------------------
1370  :
1380  HGR : POKE  -16302, 0
1390  HCOLOR = 3
1400  :
1410  FOR H =  - A TO A STEP B
1420    AA =  INT (.5 +  SQR (A ^ 2 - H ^ 2))
1430       FOR BB =  - AA TO AA
1440          CC =  SQR (BB ^ 2 + H ^ 2) * D
1450             D1 =  FN R(CC)
1460                DD = D1 * C
1470                   GOSUB 1520
1480       NEXT BB
1490  NEXT H
1500  :
1510  STOP
1520  :
1530  REM  ------------------------------------------------
1540  :
1550  X = BB + (H / B) + E
1560  Y = DD - (H / B) + F
1570     X1 = INT (.85 * X)
1580     Y1 = INT (.9 * (G - Y))
1590        IF Y1 < 0 OR Y1 > 190 THEN  RETURN
1600     HPLOT X1,Y1
1610  :
1620  REM  ERASE BACKGROUND
1630     HCOLOR= 0: REM  BLACK
1640     HPLOT X1, (Y1 + 1) TO X1, 190
1650     HCOLOR= 3: REM  WHITE AGAIN
1660  :
1670  RETURN
```

```
100  REM  --- SAVE PICTURE ---
110  :
120  PRINT:PRINT:PRINT
130  INPUT "NAME OF PICTURE? ";A$
140  PRINT CHR$(4);"BSAVE ";A$;"A$2000,L$1FFF"
150  END
```

```
100  REM  --- DISPLAY PICTURE ---
110  :
120  PRINT:PRINT:PRINT
130  PRINT CHR$(4);"BLOAD ";A$;",A$2000"
140  POKE  -16302, 0
150  POKE  -16304, 0
160  POKE  -16297, 0
170  POKE  -16300, 0
180  END
```



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PRA-43080	*Extra ribbons pkg. of 2*	**$9.95**

8023 DOT MATRIX - NEC

100 CPS, proportional spacing, hi-resolution graphics, correspondence quality printing, bi-directional tractor & friction feed.

NEC-8023A	*8023 parallel*	**$499.95**
NEC-8023-01	*8023 ribbon*	**$11.95**

TP-1 LETTER QUALITY - SCM

12 CPS daisy wheel printer from Smith Corona.

PRD-45101	*Centronics parallel*	**$648.95**
PRD-45102	*RS-232C serial*	**$648.95**

LETTER QUALITY PRINTER - Jade

Uses standard daisy wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover.

PRD-11001	*Centronics parallel*	**$899.95**
PRD-11002	*RS-232C serial model*	**$969.95**
PRA-11000	*Tractor Option*	**$169.95**

KSR DAISY WHEEL - Anderson-Jacobson

Letter quality communications terminal/printer with full typewriter keyboard, 30 CPS Diablo print mechanism, RS-232 interface, includes free printer stand with deluxe casters, print wheel, ribbon, friction feed standard (tractor feed optional), factory refurbished with 30 day warranty, shipped freight collect.

PRD-99100	*AJ KSR printer*	**$995.00**
PRA-99200	*Tractor option*	*$150.00*

PRINTER PALS - F.M.J. Inc.

Desk top printer stand and continuous form paper holder.

PRA-99080	*for MX-80, MX-80FT, Oki 82A, NEC*	**$29.95**
PRA-99100	*for MX-100, Oki 83A & 84*	**$34.95**
PRA-99700	*for letter quality printers*	**$49.95**

5¼" Disk Drives

Tandon TM100-1	*single-sided double-density 48 TPI*	**MSM-551001**	$219.95 ea	2 for **$199.95 ea**
Shugart SA400L	*single-sided double-density 40 track*	**MSM-104000**	$234.95 ea	2 for **$224.95 ea**
Shugart SA455	*half-size double-sided 48 TPI*	**MSM-104550**	$349.95 ea	2 for **$329.95 ea**
Shugart SA465	*half-size doule-sided 96 TPI*	**MSM-104650**	$399.95 ea	2 for **$379.95 ea**
Tandon TM100-2	*double-sided double-density 48 TPI*	**MSM-551002**	$294.95 ea	2 for **$269.95 ea**
Shugart SA450	*double-sided double-density 35 track*	**MSM-104500**	$349.95 ea	2 for **$329.95 ea**
Tandon TM100-3	*single-sided double-density 96 TPI*	**MSM-551003**	$294.95 ea	2 for **$269.95 ea**
Tandon TM100-4	*double-sided double-density 96 TPI*	**MSM-551004**	$394.95 ea	2 for **$374.95 ea**
MPI B-51	*single-sided double-density 40 track*	**MSM-155100**	$234.95 ea	2 for **$224.95 ea**
MPI B-52	*double-sided double-density 40 track*	**MSM-155200**	$344.95 ea	2 for **$334.95 ea**
MPI B-91	*single-sided double-density 77 track*	**MSM-155300**	$369.95 ea	2 for **$359.95 ea**
MPI B-92	*double-sided double-density 77 track*	**MSM-155400**	$469.95 ea	2 for **$459.95 ea**

5¼" Cabinets with Power Supply

END-000216	*Single cab w/power supply*	**$69.95**
END-000226	*Dual cab w/power supply*	**$94.95**

8" Disk Drives

Shugart SA810	*half-size single-sided double-density*	**MSF-108100**	$424.95 ea	2 for **$394.95 ea**
Shugart SA860	*half-size double-sided double-density*	**MSF-108600**	$574.95 ea	2 for **$549.95 ea**
Shugart SA801R	*single-sided double-density*	**MSF-10801R**	$394.95 ea	2 for **$389.95 ea**
Shugart SA851R	*double-sided double-density*	**MSF-10851R**	$554.95 ea	2 for **$529.95 ea**
Tandon TM848-1	*single-sided double-den thin-line*	**MSF-558481**	$379.95 ea	2 for **$369.95 ea**
Tandon TM848-2	*double-sided double-den thin-line*	**MSF-558482**	$494.95 ea	2 for **$484.95 ea**
Qume DT-8	*double-sided double-density*	**MSF-750080**	$524.95 ea	2 for **$498.95 ea**
Mitsubishi M2894-63	*double-sided double-density*	**MSF-289463**	$494.95 ea	2 for **$474.95 ea**
Siemens FDD 100-8	*single-sided double-density*	**MSF-201120**	$384.95 ea	2 for **$349.95 ea**

Dual Disk Sub-Systems

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power supply, power cable kit, power switch, line cord, fuse holder, cooling fan, never-mar rubber feet, all necessary hardware to mount 2-8" disk drives, power supply, and fan, does not include signal cable.

Dual 8" Sub-Assembly Cabinet

END-000420	*Bare cabinet*	**$59.95**
END-000421	*Cabinet kit*	**$225.00**
END-000431	*A & T*	**$359.95**

8" Sub-Systems - Single Sided, Double Density

END-000423	*Kit w/2 FD100-8Ds*	**$975.00**
END-000424	*A & T w/2 FD100-8Ds*	**$1175.00**
END-000433	*Kit w/2 SA-801Rs*	**$999.95**
END-000434	*A & T w/2 SA-801Rs*	**$1195.00**

8" Sub-Systems - Double Sided, Double Density

END-000426	*Kit w/2 DT-8s*	**$1224.95**
END-000427	*A & T w/2 DT-8s*	**$1424.95**
END-000436	*Kit w/2 SA-851Rs*	**$1274.95**
END-000437	*A & T w/2 SA-851Rs*	**$1474.95**

Prices may be slightly higher at our retail locations. Please contact the store in your area for exact pricing.

IBM PC Accessories

512K PC/RAM STACK - Hammond

A high quality, high density memory expansion board for your PC, cool-quiet-reliable operation, full parity checking, unique stacking sockets, expandable from 256K to 512K, MDRIVE high speed RAMdisk software only $25.00 with 256K or 512K board purchase.

MEX-25600A	*256K assembled & tested*	**$795.00**
MEX-51200A	*512K assembled & tested*	**$999.95**
MEX-25600S	*MDRIVE disk emulator*	**$25.00**

256K PC/RAM - Hammond Engineering

* *User expandable from 64K to 256K, same high quality standards as the RAM Stack above, designed for medium memory expansion requirements.*

* **MEX-64000A**	*64K assembled & tested*	**$299.95**
MEX-128000A	*128K assembled & tested*	**$399.95**
MEX-192000A	*192K assembled & tested*	**$499.95**
MEX-256000A	*256K assembled & tested*	**$569.95**

PC/SASI RAM - Hammond Engineering

Three boards in one, 256K of RAM, RS-232 asynchronous serial interface, and a SASI (Shugart Assoc Standard Interface) hard disk interface.

IOX-6000A	*PC/SASI RAM*	**$1095.00**

PC EXTENDER CARD - Computel

High quality extender card with free connectors for IBM PC bus.

TSX-300A	*A & T with connectors*	**$42.95**

WIRE WRAP BOARD - Computel

Highest quality, extremely versatile proto typing board with gold plated card edge for IBM PC.

TSX-310A	*Proto board*	**$59.95**

Jade Bus Probe

THE BUS PROBE - Jade

Inexpensive S-100 Diagnostic Analyzer

So your computer is down. And you don't have an oscilloscope. And you don't have a front panel... You're not alone - most computers have their occasional bad days. But without diagnostic equipment such as an oscilloscope (expensive!) or a front panel (expensive!), it can be very difficult to pinpoint the problem. Even if you have an extender board with a superfast logic probe, you can't see more than one signal at a time. You're stuck, right?

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Whether you're a hobbyist with a cantankerous kluge or a field technician with an anxious computer owner breathing down your neck, you'll find THE BUS PROBE speeds your repair time remarkably. Just plug in THE BUS PROBE and you'll be able to see all the IEEE S-100 signals in action. THE BUS PROBE allows you to see inputs, outputs, memory reads and writes, instruction fetches, DMA channels, vectored interrupts, 8 or 16 bit wide data transfers, plus the three bus supply voltages.

An on-board pulse generator can provide repetitive resets, interrupts, or wait states, for trouble shooting.

TSX-200B	*Bare board*	**$59.95**
TSX-200K	*Kit*	**$119.95**
TSX-200A	*A&T*	**$149.95**

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Disk Drive for Apple $289.95

Modems

SIGNALMAN - Anchor

Direct-connect automatic answer/originate selection, 300 Baud full duplex, Bell 103, includes RS-232 cable

IOM-5600A	*Signalman*	**$89.95**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A	*Smartmodem*	**$224.95**
IOK-1500A	*Hayes Chronograph*	**$218.95**
IOM-2010A	*Micromodem II*	**$328.95**
IOM-2012A	*Terminal program for MMII*	**$89.95**
IOM-1100A	*Micromodem 100*	**$368.95**

APPLE-CAT - Novation

Software selectable 1200 or 300 Baud, direct connect, auto-answer/auto-dial,touch & pulse dialing, auxiliary 3-wire RS-232C serial port for printer

IOM-5232A	*Save $50.00*	**$324.95**

1200 BAUD SMARTMODEM - Hayes

1200 and 300 baud, all the features of the standard Smartmodem plus 1200 baud, 212 compatible, full or half duplex.

IOM-5500A	*Smartmodem 1200*	**$599.95**

1200 BAUD AUTO CAT - Novation

212 Auto Cat, 1200 & 300 baud, auto dial/answer/disconnect, LED readout displays mode, analog/digital loop-back self tests, usable with multi-line phones.

IOM-5231A	*212 Auto Cat*	**$649.95**

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwith 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201	*List price $189.95*	**$129.95**

12" GREEN SCREEN - NEC

20 MHz bandwidth, P31 phosphor ultra-high resolution video monitor with audio.

VDM-651200	*Deluxe model*	**$199.95**
VDM-651260	*Economy model*	**$149.95**

12" COLOR MONITOR - NEC

High resolution color monitor with audio.

VDC-651212	*Color monitor*	**$389.95**
NEC-1202D	*RGB color monitor*	**$999.95**

13" COLOR MONITORS - BMC

18 MHz RGB & composite video color monitors.

VDC-421320	*13" RGB Color*	**$329.95**
VDC-421310	*13" Composite video*	**$299.95**
VDX-420090	*RGB card for Apple*	**$149.95**

COLOR MONITORS - Amdek

Reasonably priced color video monitors.

VDC-80130	*13" Color I*	**$379.95**
VDC-801320	*13" Color II*	**$894.95**
IOV-2300A	*DVM board for Apple*	**$199.95**

AMBER or GREEN MONITORS - Jade

High resolution 18 MHz compact video monitors.

VDM-751210	*12" Amber phosphor*	**$149.95**
VDM-751220	*12" Green phosphor*	**$139.95**
VDM-750910	*9" Amber phosphor*	**$149.95**
VDM-750920	*9" Green phosphor*	**$139.95**

EPROM Erasers

ULTRA-VIOLET EPROM ERASERS

Inexpensive erasers for industry or home.

XME-3100A	*Spectronics w/o timer*	**$69.50**
XME-3101A	*Spectronics with timer*	**$94.50**
XME-3200A	*Economy model*	**$39.95**

Single User System

THREE BOARD SET - SD Systems

4 MHz Z-80A CPU, 64K RAM (optional 256K), serial I/O port, parallel I/O port, double density disk controller, CP/M 2.2 & manual set, system monitor, control & diagnostic software. Includes SBC-200, 64K ExpandoRAM II, Versafloppy II, & CP/M 2.2 - all boards are assembled & tested.

Board set with 64K of RAM	**$1095.00**
Board set with 256K of RAM	**$1295.00**

Apple II Accessories

APPLE DISK DRIVE - Fourth Dimension

Totally Apple compatible, 143,360 bytes per drive on DOS 3.3, half-track capability - reads all Apple software, plugs right in to Apple controller as second drive, DOS 3.3, 3.2.1, Pascal, & CP/M compatible.

MSM-123200	*40 Track add on Apple drive*	**$289.95**
MSM-123200	*Controller with free DOS 3.3*	**$99.95**

16K RAM CARD - for Apple II

Expand your Apple II to 64K, use as language card, full 1 year warranty. Why spend $175.00 ?

MEX-16700A	*Save over $100.00*	**$69.95**

Z-80 CPU CARD - for Apple II

Two computers in one, Z-80 & 6502, more than doubles the power and potential of your Apple, includes Z-80 CPU card CP/M and complete manual set.

CPX-62800A	*A & T with software*	**$249.95**

APPLE-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer/auto-dial, auxiliary 3-wire RS232C serial port for printer.

IOM-5232A	*Save $50.00!!!*	**$325.95**

8" DISK CONTROLLER - Vista

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CP/M 2.2, Shugart & Qume compatible

IOD-2700A	*A & T*	**$499.95**

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package	*Kit*	**$1495.00**
1 MegaByte Package	*A & T*	**$1695.00**
2 MegaByte Package	*Kit*	**$1795.00**
2 MegaByte Package	*A & T*	**$1995.95**

VISION 80 - Vista Computer

80 column x 24 line video card for Apple II, 128 ASCII characters, upper and lower case, 9 x 10 dot matrix with 3 dot descenders, standard data media terminal control codes, CP/M Pascal & Fortran compatible, 50/60 Hz

IOV-2400A	*Vista Vision 80*	**$299.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A	*A & T*	**$179.95**

HI-RES GRAPHICS CARD - Genie

Intelligent printer interface and control card allows full high resolution graphics and screen dumps.

IOP-2405A	*Genie for Epson*	**$119.95**
IOP-2410A	*Genie for Okidata*	**$119.95**
IOP-2415A	*Genie for NEC/C. Itoh*	**$119.95**

Power Strips

ISOBAR - GSC

Isolates & protects your valuable equipment from high voltage spikes & AC line noise, inductive isolated ground, 15 amp circuit breaker, U.L. listed

EME-115103	*3 socket*	**$39.50**
EME-115105	*4 socket*	**$49.50**
EME-115100	*8 socket*	**$54.50**
EME-115110	*9 socket rackmount*	**$74.50**

Single Board Computer

SUPERQUAD - Adv. Micro Digital

Single board, standard size S-100 computer system, 4 MHz Z-80A, single or double density disk controller for 5¼" or 8" drives, 64K RAM, extended addressing, up to 4K of EPROM, 2 serial & 2 parallel I/O ports, real time interrupt clock, CP/M compatible.

CPC-30800A	*A & T*	**$724.95**
IOX-4232A	*Serial I/O adapter*	**$29.95**

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook.

CPS-30100K	*Kit with workbook*	**$299.95**
CPS-30100A	*A & T with workbook*	**$469.95**

AIM-65 - Rockwell International

Complete 6502 microcomputer with alphanumeric display, printer, keyboard, & instruction manual.

CPK-50165A	*1K AIM-65*	**$424.95**
CPK-50465A	*4K AIM-65*	**$474.95**
SFK-74600008E	*8K Basic ROM*	**$64.95**
SFK-64600004E	*4K assembler ROM*	**$43.95**
SFK-74600020E	*PL/65 ROM*	**$84.95**
SFK-74600010E	*Forth ROM*	**$64.95**
SFK-74600030E	*Instant Pascal*	**$99.95**
PSX-030A	*Power supply*	**$64.95**
ENX-000002	*Enclosure*	**$54.95**

SPECIAL PACKAGE

4K AIM-65, 8K Basic, power supply, & enclosure

Special Package Price	**$649.95**

S-100 EPROM Boards

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with software.

MEM-99520K	*Kit with software*	**$189.95**
MEM-99520A	*A & T with software*	**$249.95**

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K	*Kit with manual*	**$154.95**
MEM-99510A	*A & T with manual*	**$219.95**

EPROM BOARD - Jade

16K or 32K uses 2708 or 2716 EPROMs, 1K boundary.

MEM-16230K	*Kit w/o EPROMs*	**$79.95**
MEM-16230A	*A & T w/o EPROMs*	**$119.95**

S-100 Video Boards

SPECTRUM COLOR - CompuPro

Full-function color graphics board, up to 8 colors, 256 x 192 graphics, parallel I/O port, 8K RAM.

IOV-1870A	*A & T*	**$348.95**
IOV-1870C	*CSC*	**$398.95**

MICROANGELO - Scion

Ultra-high-resolution 512 x 480, 256 color or black & white S-100 video board

IOV-1500A	*A & T*	**$799.95**

S-100 MotherBoards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

	6 Slot (5¼" x 8⅝")	
MBS-061B	*Bare board*	**$22.95**
MBS-061K	*Kit*	**$39.95**
MBS-061A	*A & T*	**$69.95**
	12 Slot (9¾" x 8⅝")	
MBS-121B	*Bare board*	**$34.95**
MBS-121K	*Kit*	**$69.95**
MBS-121A	*A & T*	**$109.95**
	18 Slot (14½" x 8⅝")	
MBS-181B	*Bare board*	**$54.95**
MBS-181K	*Kit*	**$99.95**
MBS-181A	*A & T*	**$149.95**

ACTIVE TERMINATOR - CompuPro

A true mother's helper.

TSX-100A	*A & T*	**$59.45**

Prices may be slightly higher at our retail locations. Please call the store nearest you for local price and availability.

64K Static RAM $299.95

S-100 CPU Boards

8086/8087 - CompuPro

16 bit, 8 or 10 MHz 8086 CPU with provisions for 8087 & 80130.

CPU-70520A	*8 MHz 8086 A & T*	**$624.95**
CPU-70520C	*8 MHz 8086 CSC*	**$764.95**
CPU-70530A	*with 8087 A & T*	**$1224.95**
CPU-70530C	*with 8087 CSC*	**$1455.95**

8085/8086 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 MHz, accesses 16 Megabytes of memory.

CPU-20510A	*6 MHz A & T*	**$398.95**
CPU-20510C	*6/8 MHz CSC*	**$497.95**

CPU-Z - CompuPro

2/4 MHz Z80A CPU, 24 bit addressing.

CPU-30500A	*2/4 MHz A & T*	**$279.95**
CPU-30500C	*3/6 MHz CSC*	**$374.95**

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RAM, 8K ROM space, monitor PROM included.

CPC-30200A	*A & T*	**$399.95**

THE BIG Z - Jade

2 or 4 MHz switchable Z-80 CPU board with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600.

CPU-30201B	*Bare board w/manual*	**$35.00**
CPU-30201K	*Kit with manual*	**$149.95**
CPU-30210A	*A & T with manual*	**$199.95**

CB-2 - SSM Microcomputer

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K	*Kit with manual*	**$229.95**
CPU-30300A	*A & T with manual*	**$274.95**

2810 Z-80 CPU - C.C.S.

2 or 4 MHZ Z-80 CPU with serial I/O port & on-board monitor PROM, front panel compatible.

CPU-30400A	*A & T with PROM*	**$289.95**

2820 Z-80 DMA CPU - C.C.S.

4 MHz Z-80 CPU board with 2 serial I/O ports & Centronics parallel I/O port, separate data & status ports, DMA daisy chain compatible.

CPU-30420A	*A & T with manual*	**$569.95**

S-100 Disk Controllers

DISK 1 - CompuPro

8" or 5¼" DMA disk controller, single or double density, single or double sided, 10 MHz.

IOD-1810A	*A & T*	**$449.95**
IOD-1810C	*CSC*	**$554.95**
SFC-52506580F	*8" CP/M 2.2 for Z-80*	**$174.95**
SFC-52506586F	*8" CP/M 2.2 for 8086*	**$299.95**
SFO-54158000F	*Oasis single user*	**$499.95**
SFO-54158002F	*Oasis multi-user*	**$849.95**

VERSAFLOPPY II - SD Systems

Double density disk controller for any combination of 5¼" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts, CP/M 2.2 & Oasis compatible, control/diagnostic software PROM included.

IOD-1160A	*A & T with PROM*	**$359.95**
SFC-55009047F	*CP/M 2.2 with VF II*	**$99.95**

2242 DISK CONTROLLER - C.C.S.

5¼" or 8" double density disk controller with on-board boot loader ROM, free CP/M 2.2 & manual set.

IOD-1300A	*A & T with CP/M 2.2*	**$399.95**

DOUBLE D - Jade

High reliablity double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100, can function in multi-user interrupt driven bus.

IOD-1200B	*Bare board & hdwr man*	**$59.95**
IOD-1200K	*Kit w/hdwr & sftwr man*	**$299.95**
IOD-1200A	*A & T w/hdwr & sftwr man*	**$325.95**
SFC-59002001F	*CP/M 2.2 with Double D*	**$99.95**

S-100 Memory Boards

256K RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K x 1 RAM chips, compatible with CP/M, MP/M, Oasis, Cromemco, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A	*64K A & T*	**$474.95**
MEM-65128A	*128K A & T*	**$574.95**
MEM-65192A	*192K A & T*	**$674.95**
MEM-65256A	*256K A & T*	**$774.95**
SFC-55009000F	*RAMDISK sftwr CP/M 2.2*	**$44.95**
SFC-55009000F	*RAMDISK with EXRAM III*	**$24.95**

128K RAM 21 - CompuPro

128K x 8 bit or 64K x 16 bit static RAM board, 12 MHz, 24 bit addressing.

MEM-12810A	*A & T*	**$1609.95**
MEM-12810C	*CSC*	**$1794.95**

64K RAM 17 - CompuPro

64K CMOS static RAM board, 10 MHz, low power less than 4 watts, DMA compatible, 24 bit addressing.

MEM-64180A	*64K A & T*	**$549.95**
MEM-64180C	*64K CSC*	**$698.95**

64K RAM 16 - CompuPro

32K x 16 bit or 64K x 8 bit low power static RAM board, 10 MHz, 24 bit addressing.

MEM-32180A	*RAM 16 A & T*	**$598.95**
MEM-32180C	*RAM 16 CSC*	**$698.95**

64K STATIC RAM - SSM

IEEE 696/S-100 standard, up to 6MHz/8 Bit, 12MHz/16 Bit, 24 Bit extended addressing, disable-able in 2K increments

MEM-64300A	*A & T*	**$499.95**

64K STATIC RAM - Mem Merchant

64K static S-100 RAM card, 4 to 16K banks up to 8 MHz.

MEM-64400A	*64K A & T*	**$499.95**

64K STATIC RAM - Jade

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CIRCLE 189 ON READER SERVICE CARD

Linked Lists Are Alive And Well In Computer Graphics

Mark Coleman

What in the world is a linked list? *Linked List* is a fancy buzz phrase that means each position in the list contains, among other things, a map showing how to get to the next position in the list, much like a treasure hunt.

Lists that are not linked are called sequential lists. In a sequential list, the next element in the list must be in the next storage location. However in a linked list the next element value may be stored anywhere, since each element has a pointer to the location of the next element. Figure 1 shows the list (A, B, D, E, F) in both forms.

There are many advantages and disadvantages to linked lists. One disadvantage is that they take up more memory since links must be stored along with element values. One advantage is the ease of inserting or deleting elements. Say we want to insert C between B and D.

Figure 2 shows that in the sequential list all elements after B must move one storage location in the list to make room for C. This can take a great deal of time if the list is very long. But in a linked list all that need be done is change the value of the link at B so it points at the storage position of C and make the link of C point to D.

In a doubly linked list, each element has two links, one pointing to the next element and one pointing to the previous element as shown in Figure 3.

In the example above, the links are actually the values of the next storage

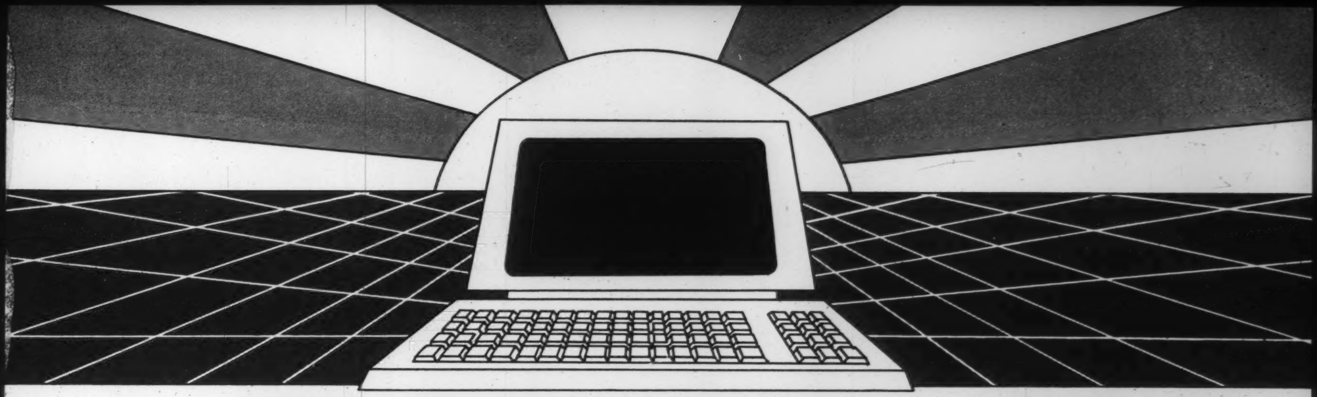
	Storage position	1	2	3	4	5
Sequential	Element value	A	B	D	E	F
	Storage position	1	150	25	300	83
Linked	Element Value	A	B	D	E	F
	Link	150	25	300	83	—

Figure 1.

	Storage position	1	2	3	4	5	6
Sequential	Element value	A	B	C	D	E	F
	Storage position	1	150	25	300	83	
Linked	Element value	A	B	D	E	F	
	Link	150	200	300	83	—	
			200				
			C				
			25				

Figure 2.

Mark D. Coleman, 2960 Brookwood, Ft. Collins, CO 80525.



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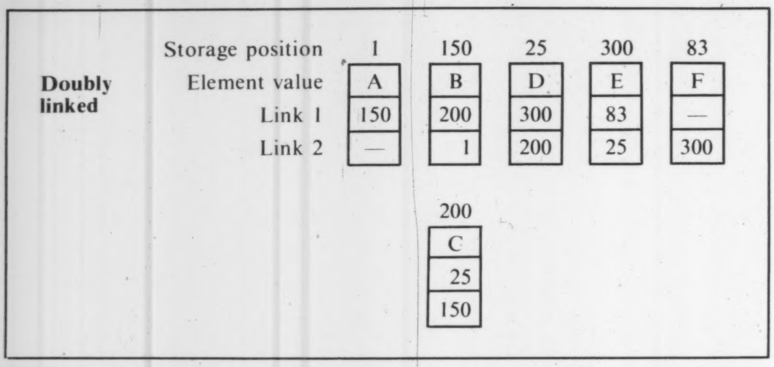

Doubly linked
Storage position
Element value
Link 1
Link 2
1
A
150
—
150
B
200
1
25
D
300
200
300
E
83
25
83
F
—
300
200
C
25
150

Figure 3.

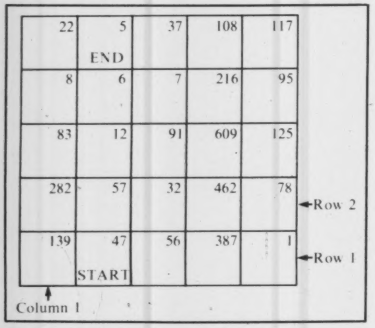

22
5
END
37
108
117
8
6
7
216
95
83
12
91
609
125
282
57
32
462
78
Row 2
139
47
START
56
387
1
Row 1
Column 1

Figure 4.

A(1, 5)=22	A(2, 5)=5	A(3, 5)=37	A(4, 5)=108	A(5, 5)=117
A(1, 4)=8	A(2, 4)=16	A(3, 4)=7	A(4, 4)=216	A(5, 4)=95
A(1, 3)=83	A(2, 3)=12	A(3, 3)=91	A(4, 3)=609	A(5, 3)=125
A(1, 2)=282	A(2, 2)=57	A(3, 2)=32	A(4, 2)=462	A(5, 2)=78
A(1, 1)=139	A(2, 1)=47	A(3, 1)=56	A(4, 1)=387	A(5, 1)=1

Figure 5.

location. In general, links are any pieces of information which point to the location of the next value. This article shows how linked lists can be useful in solving a game known as Magic Path.

The Game

The game goes like this. Given the 5x5 matrix in Figure 4, draw a line which starts at START and ends at END. The line may not cross the same square twice, it may not go diagonally or out of the matrix, and the sum of the numbers crossed by the line must be 1958. Sounds easy.

I spent a few minutes trying to figure out a short cut solution, but soon decided that a systematic trial and error approach would be faster. All I had to do was try each possible path. Figuring out how to do this systematically is where the fun comes in.

The Algorithm

Since the matrix is a two-dimensional array, I decided to store the data in the same form. For a given square, the first subscript of the array corresponds to the column and the second subscript corresponds to the row as shown in Figure 5.

But how do I decide which direction to go from any given square? There are only four directions that are legal so I numbered them 1 to 4 as in Figure 6.

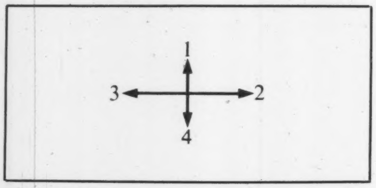


Figure 6.

When I first enter a square I will try to exit from it in direction 1. If for some reason I cannot exit in the desired direction — if I run into an edge or the new total will exceed 1958 — then I simply increment my direction pointer and try the next direction. If that direction doesn't work, I increment it again and again until I find a direction I can go or until I exhaust all four possible directions. For example, in Figure 7, directions 1 and 2 from square H go off the matrix, so direction 3 is chosen making I the next square.

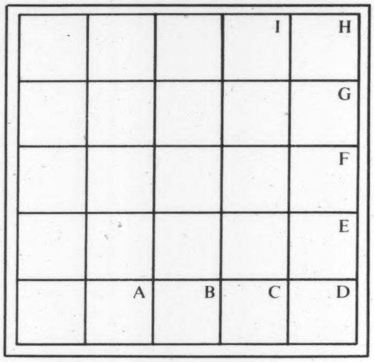
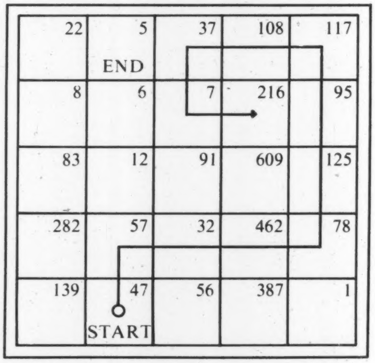


Figure 7.

To generate the Row (x), Column (y) coordinates of the next square, I wrote a "direction decoder" routine which relates the direction number 1 to 4 to the required change in subscripts.

```
IF D=1 THEN Y=Y+1
IF D=2 THEN X=X+1
IF D=3 THEN X=X-1
IF D=4 THEN Y=Y-1
```

But what if I exhaust all possible directions from a given square, the classic "You can't get there from here" problem? I must then go back to the previous square on the path and try the next direction from that square. For example trying to select the next square from square "216" in Figure 8 results in: direction 1 crosses a square twice; direction 2 crosses a square twice; direction 3 crosses a square twice; direction 4 causes sum to be greater than 1958.


22
5
END
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108
117
8
6
7
216
95
83
12
91
609
125
282
57
32
462
78
139
47
START
56
387
1

Figure 8.

In this case square 216 must be eliminated from the path and the next direction must be selected from square 7.

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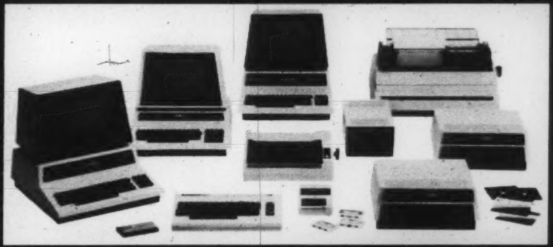

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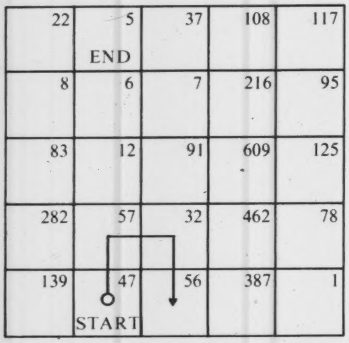
A(1, 1, 1)=value of square (1, 1)
A(1, 1, 2)=direction to go to find the next square: Forward Link
A(1, 1, 3)=direction to go to find the previous square: Backward Link

A(1, 2, 1)=value of square (1, 2)
A(1, 2, 2)=direction to go to find the next square: Forward Link
A(1, 2, 3)=direction to go to find the previous square: Backward Link

etc.

Figure 9.



22	5 END	37	108	117
8	6	7	216	95
83	12	91	609	125
282	57	32	462	78
139	47 START	56	387	1

A(2, 1, 1)=47	value
A(2, 1, 2)=1	up
A(2, 1, 3)=0	
A(2, 2, 1)=57	value
A(2, 2, 2)=2	right
A(2, 2, 3)=4	down
A(3, 2, 1)=32	value
A(3, 2, 2)=4	down
A(3, 2, 3)=3	left
A(3, 1, 1)=56	value
A(3, 1, 2)=0	
A(3, 1, 3)=1	up

Figure 10.

Now I realized I had a problem. I needed two pieces of information that I didn't have yet. First of all, square 216 needs to know how to find square 7 and then square 7 needs to know which direction it tried last so it knows which direction to try next, or in other words it needs to know how it got to square 216. I needed "links" forward and backward in the list of squares on the path.

I decided to expand my two-dimensional array, which was storing the values of the squares, into a three-dimensional array as in Figure 9.

The values for the links are the numbers 1 through 4 corresponding to the directions shown in Figure 6. In addition, when a square is not yet on the path, I set the links to zero. This makes it easy to tell whether or not a given square is available or has already been used. Remember that you can't cross a square twice.

To illustrate this scheme consider the path shown in Figure 10.

The zeros arise from the fact that square (2, 1) is the start square so it has no previous square and square (3, 1) is the last square shown so it has no next square.

Once I figured out the linking scheme all I had to do was check for a total of 1958 and current coordinates equal to the END square.

Graphics

To keep myself from feeling completely neglected as my computer solved this problem, I added a few lines to the program to draw the matrix on my screen and to draw and erase the different paths as they were tried. Having the different paths drawn on my CRT not only made the program more fun to watch, but it also made debugging much easier since I already had a mental picture of how the search should proceed.

The machine I used was a Hewlett-

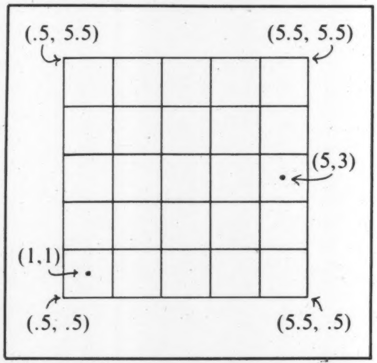


Figure 11.

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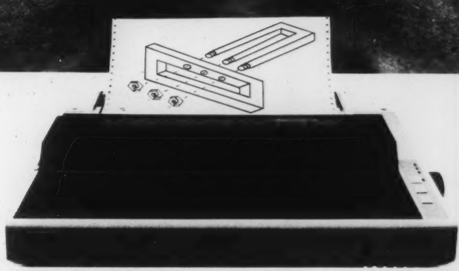

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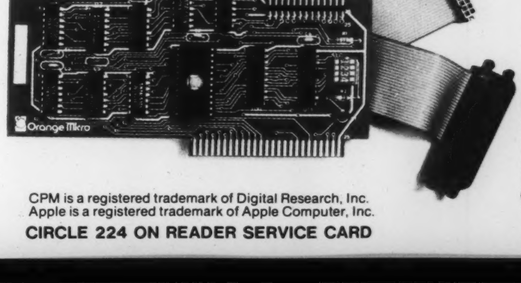

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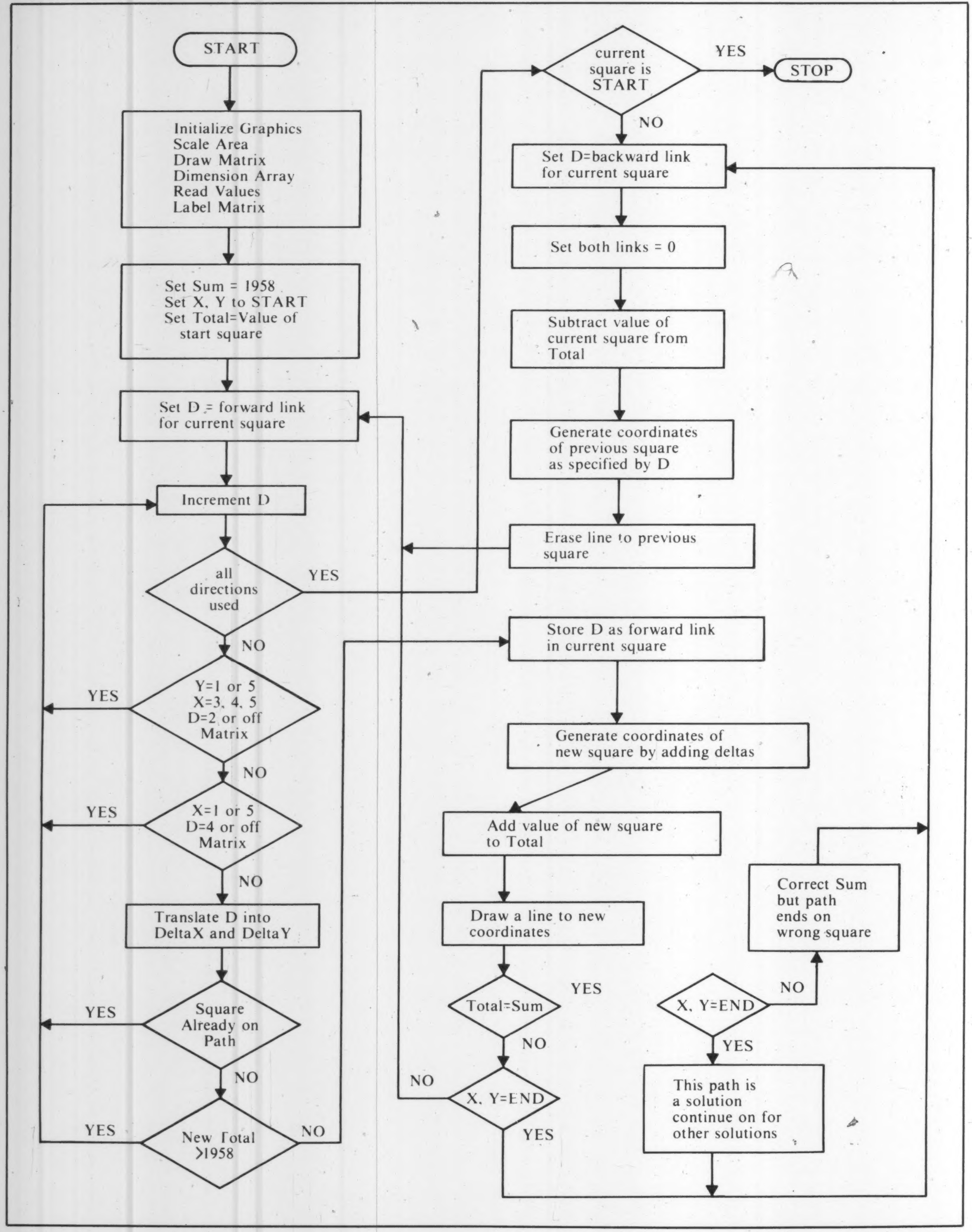
Figure 12.


START
Initialize Graphics
Scale Area
Draw Matrix
Dimension Array
Read Values
Label Matrix
Set Sum = 1958
Set X, Y to START
Set Total=Value of start square
Set D = forward link for current square
Increment D
all directions used
YES
NO
Y=1 or 5 X=3, 4, 5 D=2 or off Matrix
YES
NO
X=1 or 5 D=4 or off Matrix
YES
NO
Translate D into DeltaX and DeltaY
Square Already on Path
YES
NO
New Total >1958
YES
NO
current square is START
YES
STOP
NO
Set D=backward link for current square
Set both links = 0
Subtract value of current square from Total
Generate coordinates of previous square as specified by D
Erase line to previous square
Store D as forward link in current square
Generate coordinates of new square by adding deltas
Add value of new square to Total
Draw a line to new coordinates
Total=Sum
YES
NO
X, Y=END
NO
YES
X, Y=END
NO
YES
Correct Sum but path ends on wrong square
This path is a solution continue on for other solutions

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Packard 9845B which has really super graphics, but you don't need anything too super to perform most of the operations I discuss below.

By scaling my graphics area (.5, 5.5, .5, 5.5) and drawing the matrix with corners at (.5, .5), (.5, 5.5), (5.5, 5.5), and (5.5, .5), the centers of the squares occur at integer coordinates corresponding to the subscripts of my A array. (Figure 11.)

Initially I do a MOVE to the center of the START square. Then, after I decide which square to move to next, I do a DRAW to the new coordinates. If I arrive at a dead end and have to back up, I erase lines by doing a PEN -1 and a DRAW to the coordinates of the previous square. On my HP 9845B, PEN-1 means erase.

If your machine doesn't have a SCALE statement just MOVE and DRAW to 3*X,3*Y or 5*X,5*Y or whatever scale factor is necessary to get a reasonable size matrix and pathway.

Also if you don't have MOVE, DRAW commands you will want to write a little subroutine which lets you draw horizontal and vertical lines. The program in Listing 1, or some modification of it, ought to work on your machine. As shown it will run on a TRS-80 or the like. It only draws vertical and horizontal lines, but that's all you need for this application.

To do a MOVE, simply set XS equal to the x-coordinate of the starting point and YS equal to the y-coordinate.

To do a DRAW set XE equal to the x-coordinate of the end point and YE equal to the y-coordinate. Then do a GOSUB 1000.

The routine draws a line from XE, YE to XS, YS. Then it sets XS=XE and YS=YE so you can draw a line starting at the end of the last line without redefining the startpoint.

P determines whether the line is to be drawn or erased (-1 means erase, any other value means draw).

Faster Solutions

After I got the program running, I noticed that the search spent a great deal of time on paths that I knew wouldn't work. For example, once a square in column 1 or 5 is entered (sides) there is no way to get to the END square by going down (direction 4). Also when Row 1 or 5 is entered (top and bottom) and I'm in columns 3, 4 or 5, there is no way to get to the END square by going right (direction 2). Also the END square should be treated as a dead end.

I was able to avoid searching these paths by modifying a few lines of code in the routine which checks to see if the proposed direction is legal. By eliminating these paths I was able to speed up the search considerably.

Conclusion

Figure 12 and Listing 2 show my flowchart and program. If you rewrite it for your own machine be careful to undo all your steps completely as you travel backward from a dead end. It is very easy to forget something. It took me a while to figure out that I was forgetting to subtract the values of the squares as I left them.

There are several solutions which result in a total of 1958, but only four

Listing 1.

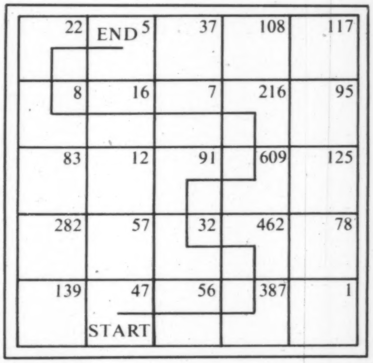
```
1000  XI=SGN(XE-XS):YI=SGN(YE-YS)
1010  IF YI=0 OR XI=0 THEN 1100
1030  PRINT "ROUTINE ONLY DRAWS HORIZONTAL OR VERTICAL LINES"
1040  RETURN
1100  FOR I=0 TO ABS(XE-XS+YE-YS)
1110  IF P=1 THEN SET (XS,YS) ELSE RESET (XS,YS)
1120  XS=XS+XI:YS=YS+YI:NEXT
1130  XS=XE:YS=YE:RETURN
```

Listing 2.

```
10     !   THIS PROGRAM SYSTEMATICALLY SEARCHES FOR A PATH
20     !   THROUGH A MATRIX OF NUMBERS SUCH THAT THE SUM OF
30     !   ALL NUMBERS ON THAT PATH IS EQUAL TO 1589
40     !
50     GRAPHICS
70     SCALE 0,5.5,0,5.5
80     !
90     !   DRAW MATRIX
100    FOR I=.5 TO 5.5
110    MOVE .5,I
120    DRAW 5.5,I
130    MOVE I,.5
140    DRAW I,5.5
150    NEXT I
160    !
170    OPTION BASE 1  ! THIS SETS THE LOWER LIMIT FOR ARRAY SUBSCRIPTS TO ONE
180    DIM A(5,5,3)
190    !
200    !   A(XCOORD,YCOORD,1) = VALUE FOR THAT SQUARE
210    !   A(XCOORD,YCOORD,2) = LINK FORWARD  TO THE NEXT SQUARE
220    !   A(XCOORD,YCOORD,3) = LINK BACKWARD TO THE PREVIOUS SQUARE
230    !   LINK = 0 : SQUARE NOT ON PATH
240    !   LINK = 1 : UP
250    !   LINK = 2 : RIGHT
260    !   LINK = 3 : LEFT
270    !   LINK = 4 : DOWN
280    !
290    Sum=1958                 ! SET SUM FOR PATH
300    !
330    FOR I=1 TO 5
340    FOR J=1 TO 5
350    READ A(J,I,1)            ! ASSIGN VALUES TO THE SQUARES
355    A(J,I,2)=A(J,I,3)=0      ! AND SET LINKS TO 0
360    MOVE J+.125,I+.25        ! LABEL UPPER RIGHT CORNER OF EACH SQUARE WITH VALUE
370    LABEL A(J,I,1)
371    NEXT J
372    NEXT I
373    MOVE 1.75,.7
374    LABEL "START"
375    MOVE 1.75,5.3
376    LABEL "END"
390    DATA 139, 47, 56,387,  1
400    DATA 282, 57, 32,462, 78
410    DATA  83, 12, 91,609,125
420    DATA   8, 16,  7,216, 95
430    DATA  22,  5, 37,108,117
460    !
470    !   MOVE INTO "START" SQUARE
480    X=2
490    Y=1
500    MOVE X,Y
510    Total=A(X,Y,1)
520 Next_square:  D=A(X,Y,2)
530 Inc_direction:  D=D+1
540    IF D>4 THEN First_square ! HAVE ALL DIRECTIONS BEEN EXHAUSTED
560    IF (Y=1) AND ((D=4) OR (D=3) AND (X>2)) THEN Inc_direction! OFF BOTTOM OF
MATRIX
570    IF (X=5) AND ((D=2) OR (D=4)) THEN Inc_direction! OFF RIGHT
580    IF (X=1) AND ((D=3) OR (D=4)) THEN Inc_direction! OFF LEFT
590    IF (Y=5) AND ((D=1) OR (D=2) AND (X>1)) THEN Inc_direction! OFF TOP
600    !
610    !   TRANSLATE D INTO DELTA X AND DELTA Y
620    Dx=Dy=0
```

which also terminate in the END square. I have shown one of the correct paths in Figure 13. Of course, there is nothing magic about 1958 or the values in the squares. Try different values and make your own puzzles. Try a three-dimensional matrix or different searching schemes.

Singly and doubly linked lists, aside from being buzz words, can be very useful in solving many types of problems, like this one, that involve searching large amounts of data. ☐



22	END 5	37	108	117
8	16	7	216	95
83	12	91	609	125
282	57	32	462	78
139	47 START	56	387	1

Figure 13.

```
630   IF D=1 THEN Dy=1
640   IF D=2 THEN Dx=1
650   IF D=3 THEN Dx=-1
660   IF D=4 THEN Dy=-1
670   !
680   IF A(X+Dx,Y+Dy,2)<>0 THEN Inc_direction ! IS NEW SQUARE ALREADY ON PATH
700   IF Total+A(X+Dx,Y+Dy,1)>Sum THEN Inc_direction         ! IS NEW TOTAL TOO
BIG?
710   A(X,Y,2)=D    ! STORE FORWARD LINK
720   X=X+Dx        ! UPDATE COORDINATES
730   Y=Y+Dy
740   A(X,Y,3)=5-D  ! STORE BACKWARD LINK AT NEW SQUARE
750   Total=Total+A(X,Y,1) ! SAVE NEW TOTAL
760 Line:  PEN 1    ! DRAW LINE TO NEW SQUARE
770   DRAW X,Y
780   IF (Total<>Sum) AND ((X<>2) OR (Y<>5)) THEN Next_square! NOT DONE YET
781   IF (Total<>Sum) AND (X=2) AND (Y=5) THEN Previous_sqr  ! END MUST BE LAST
782   IF (Total=Sum) AND (X=2) AND (Y=5) THEN Winner         ! WINNER
800   PRINT "CORRECT SUM FOUND ON THIS PATH BUT END SQUARE IS WRONG"
810   GOTO Previous_sqr  ! CONTINUE ON FOR OTHER PATHS
830   !
840   !
850 First_square:IF (X=2) AND (Y=1) THEN Done ! CHECK TO SEE IF DONE
860 Previous_sqr:D=A(X,Y,3)
870   A(X,Y,2)=0             ! SET LINKS BACK TO 0 SINCE I'M LEAVING THIS SQUARE
880   A(X,Y,3)=0
890   Total=Total-A(X,Y,1) ! SUBTRACT VALUE OF THIS SQUARE
900   IF D=1 THEN Y=Y+1
910   IF D=2 THEN X=X+1
920   IF D=3 THEN X=X-1
930   IF D=4 THEN Y=Y-1
940   PEN -1      ! ERASE THE LINE
950   DRAW X,Y
960   GOTO Next_square    ! GO TRY ANOTHER DIRECTION
970 Winner:    PRINT "THE CURRENT PATH IS A WINNER"
971   PRINT "PRESS CONTINUE TO CONTINUE"
972   PAUSE
980   GOTO Previous_sqr !TRY TO FIND OTHER PATHS
990 Done:  ! ALL PATHS HAVE BEEN TRIED
1000  PRINT "I HAVE FINISHED SEARCHING ALL PATHS"
1010  END
```

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CIRCLE 214 ON READER SERVICE CARD

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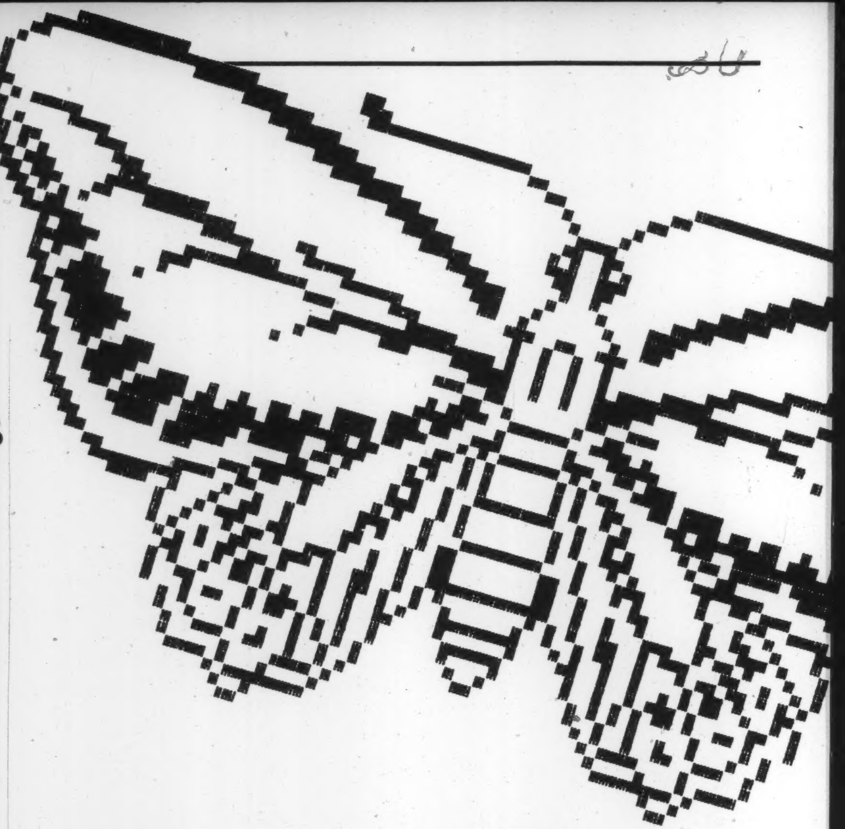

R. A. Dousette

The Epson MX-80 printer comes with a limited graphics capability. It has 64 graphics characters as shown in Figure 1. Better resolution graphics are available, but the cost for the hardware approaches $100.

I would like to have the ability to do graphics, but my need doesn't justify this expenditure. Fortunately, the graphics character set can be easily used from Apple Pascal to produce graphics that are adequate for my applications.

The Pascal graphics screen has a 192(down) by 280(across) resolution. Each MX-80 graphics character has a three (down) by two(across) resolution. Thus, if 66 lines of 80 graphics characters are printed on each page, the printed page will have a resolution of 198 by 160 dots.

In one dimension, the MX-80 will accommodate the graphics page. Going across, however, there isn't enough room to accommodate the graphics page.

The MX-80 accommodates four print sizes. They are normal size (80 characters per line), double-wide (40 characters per line), compressed (132 characters per line), and compressed double-wide (66 characters per line). By using these different print sizes, the page resolution can be changed. Double-width characters give a 198 x 80 display, compressed characters give a 198 x 264 display, and double-width compressed characters give a 198 x 132 display.

Figure 1.

ASCII Codes Of Graphics Characters

160:	161:🬀	162:🬁	163:🬂	164:🬃	165:🬄	166:🬅	167:🬆
168:🬇	169:🬈	170:🬉	171:🬊	172:🬋	173:🬌	174:🬍	175:🬎
176:🬏	177:🬐	178:🬑	179:🬒	180:🬓	181:▌	182:🬔	183:🬕
184:🬖	185:🬗	186:🬘	187:🬙	188:🬚	189:🬛	190:🬜	191:🬝
192:🬞	193:🬟	194:🬠	195:🬡	196:🬢	197:🬣	198:🬤	199:🬥
200:🬦	201:🬧	202:▐	203:🬨	204:🬩	205:🬪	206:🬫	207:🬬
208:🬭	209:🬮	210:🬯	211:🬰	212:🬱	213:🬲	214:🬳	215:🬴
216:🬵	217:🬶	218:🬷	219:🬸	220:🬹	221:🬺	222:🬻	223:█

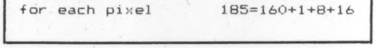
Assignment Of ASCII Codes
1
2
4
8
16
32
2
4
32
Powers of two for each pixel
ASCII code 185=160+1+8+16

Figure 2.

Use of any of the resolutions causes some distortion of the image. The distortion is least if 80 graphics characters per line are used, in which case, the horizontal dimension is shrunk by about 10%.

Figure 1 shows the ASCII codes and the corresponding graphics characters. The graphics characters have ASCII codes 160 through 223. The appropriate code is determined by adding to 160 the appropriate power of two for each of the pixels to be printed. The example in Figure 2 shows how the ASCII code of 185 is assigned to one character.

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CIRCLE 274 ON READER SERVICE CARD

I have written a Pascal procedure named DRAW that transfers a portion of the graphics screen to the printer. The procedure accepts four integer arguments, XMIN, XMAX, YMIN, and YMAX, that define a window into the graphics screen. This procedure has an internal procedure, SETCODE, that assigns the ASCII code for each block of six dots from the graphics screen by use of the Boolean function SCREENBIT.

SCREENBIT is contained in the TURTLEGRAPHICS unit. The reference SCREENBIT(I,J) looks at the graphics screen pixel with coordinates I and J and then returns a value of TRUE if the location on the screen isn't black. Otherwise, it returns the value FALSE.

By examining a 2 x 3 matrix of screen pixels, it is possible to determine the ASCII code of the graphics character that reproduces the pattern on the graphics screen.

Procedure DRAW initially sets a Boolean variable GRAFERROR as FALSE. Then, it tests the coordinates of the screen window for consistency. If the coordinates aren't correct, GRAFERROR is set at TRUE and the procedure is exited.

Some editing is also done on XMIN and XMAX. For CHARSET to work correctly on the rightmost edge of the picture, XMAX-XMIN must be an odd integer. If not odd, the procedure expands the window by half a character.

The procedure assumes normal width characters. No provision for double-width characters is made. Possible changes in the procedure include adding double-width characters and rotating the image through 90 degrees before printing it.

The program Printdemo demonstrates the use of this procedure. I borrowed the butterfly from the APPLE3:GRAFDEMO program that comes with the Language System. The program prints the butterflies in both normal (Figure 3) and compressed (Figure 4) formats.

I also drew two geometric figures by rotating a square (Figure 5) and, in the last case, expanding the square (Figure 6) as it rotates.

The GRAFRANDOM procedure illu-

Figure 3.

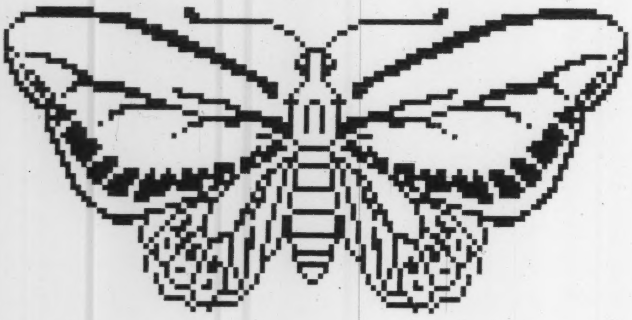


Figure 4.

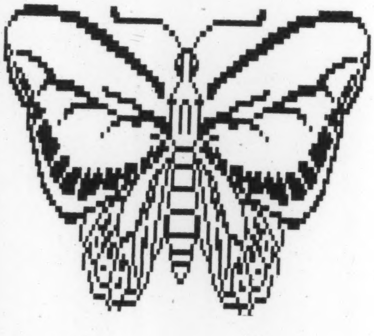


Figure 5.

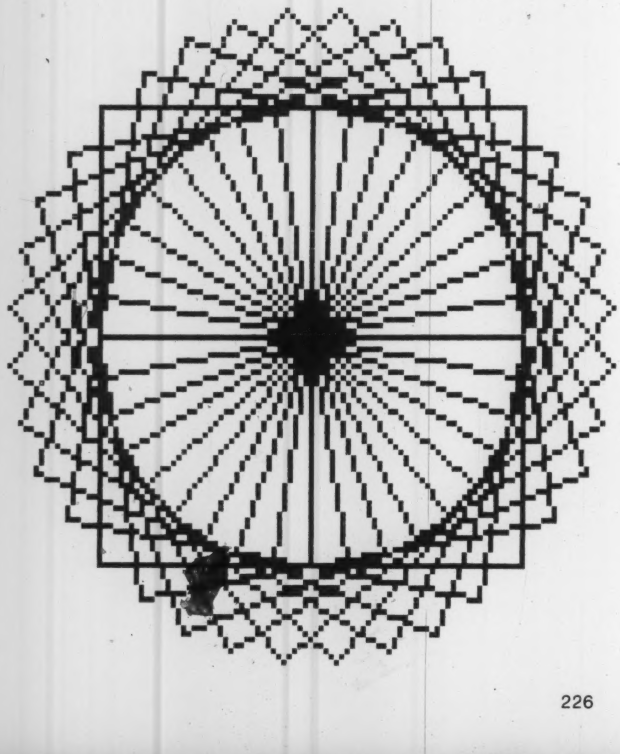
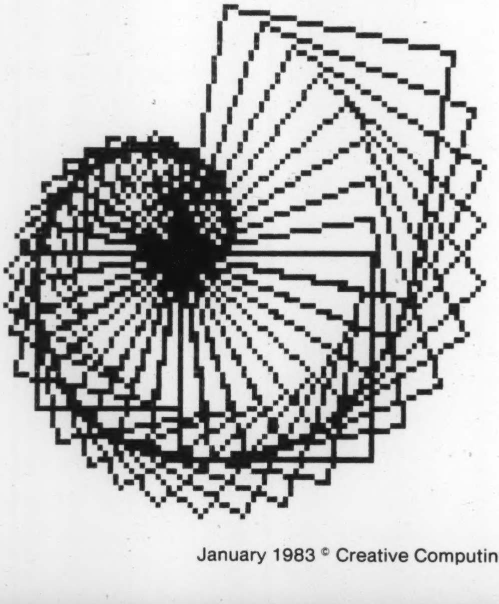


Figure 6.



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MX-80 Graphics, continued...

strates a random walk (Figure 7). It can be interpreted as the result of a coin toss experiment: with each successive toss of the coin, the total count of heads is divided by the number of tosses and the resulting ratio is plotted. The horizontal line through the graph is the 50% level. As the number of coin tosses increases, the ratio tends towards 50% (Figure 8).

The resulting graphics aren't as pretty as those from Graftrax-80, and they lose all shading because colors other than black are treated the same. They are, however, adequate for what I want, and they have the enormous consolation of being free. ☐

Figure 7.

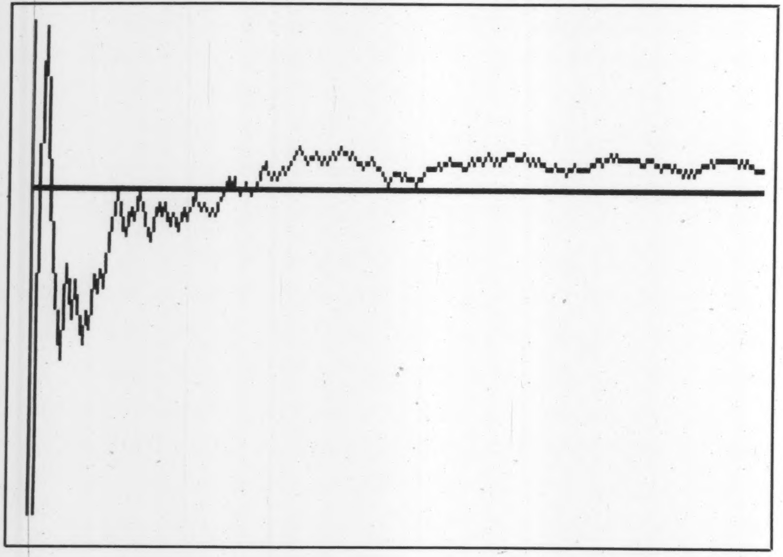
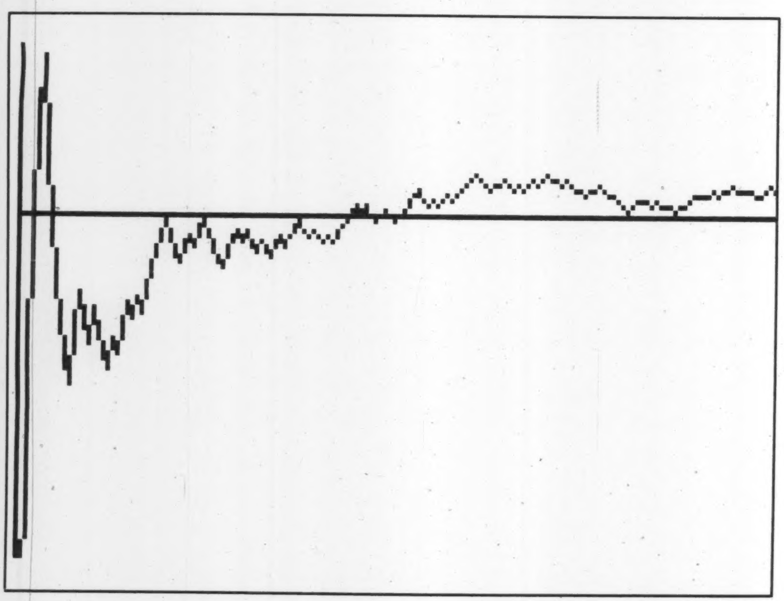


Figure 8.



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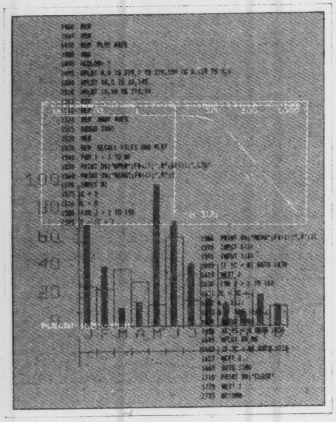

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CIRCLE 301 ON READER SERVICE CARD

MX-80 Graphics, continued...

```
PROGRAM PRINTDEMO;
(*****************************************************************)
(*                                                               *)
(*  THIS IS A PROGRAM TO DEMONSTRATE THE USE OF THE              *)
(*  EPSON MX-80 GRAPHICS CHARACTERS AND THE GRAPHICS             *)
(*  PAGE.                                                        *)
(*                                                               *)
(*****************************************************************)

USES TURTLEGRAPHICS,APPLESTUFF;
CONST XMAX=279;
      YMAX=191;
      XMID=140;
      YMID=96;

TYPE PICTURE=PACKED ARRAY[0..53,0..120] OF BOOLEAN;

VAR I,J,K,SKIP,ROW: INTEGER;
    CH: CHAR;
    PRINTER:TEXT;
    BUTTER: PICTURE;
    GRAFERROR,BIT: BOOLEAN;
PROCEDURE WAIT(TIME:INTEGER);
VAR DELAY: INTEGER;
BEGIN
  FOR DELAY:=1 TO TIME DO;
END;
PROCEDURE DRAW(XMIN,XMAX,YMIN,YMAX:INTEGER); { Transfer a portion of }
                        { the graphics screen to the printer.  Use   }
CONST NEXTFORM=140;     { coordinates XMIN, XMAX, YMIN, YMAX to set  }
      COMPCHAR=15;      { the window to the screen.                  }
      NORMCHAR=146;

  VAR GRAFCODE,XORD,YORD:INTEGER;

  PROCEDURE SETCODE(XPOS,YPOS:INTEGER); { Determine ASCII code of }
    VAR I,J,XTOP,YBOT,CHARSET:INTEGER;  { six positions from the  }
      BEGIN                             { graphics screen.        }
        CHARSET:=1;
        GRAFCODE:=160;
        XTOP:=XPOS+1;
        IF XTOP>XMAX THEN XTOP:=XMAX;
        YBOT:=YPOS-2;
        IF YBOT<YMIN THEN YBOT:=YMIN;
        FOR J:=YPOS DOWNTO YBOT DO
          FOR I:=XPOS TO XTOP DO
            BEGIN
              IF SCREENBIT(I,J) THEN GRAFCODE:=GRAFCODE+CHARSET;
              CHARSET:=2*CHARSET
            END;
      END;
  BEGIN
    GRAFERROR:=FALSE;
    IF NOT ODD(XMAX-XMIN) THEN       { Procedure SETCODE needs an even }
      IF XMAX<279 THEN  XMAX:=XMAX+1 { number of x ordinates to corr-  }
                  ELSE  XMIN:=XMIN-1;{ set the character.              }
    IF ((XMAX-XMIN>263) OR (XMAX>279) OR (XMIN<0) OR (XMIN>XMAX)
      OR (YMIN<0) OR (YMAX>191) OR (YMIN>YMAX)) THEN
        BEGIN
          GRAFERROR:=TRUE;
          EXIT(DRAW)
        END;
    IF XMAX-XMIN>159 THEN WRITE(PRINTER,CHR(COMPCHAR))
                     ELSE WRITE(PRINTER,CHR(NORMCHAR));
    YORD:=YMAX;
    REPEAT
      XORD:=XMIN;
      REPEAT
        SETCODE(XORD,YORD);
        WRITE(PRINTER,CHR(GRAFCODE));
        XORD:=XORD+2;
      UNTIL XORD>XMAX;
      WRITE(PRINTER,CHR(10));
      YORD:=YORD-3;
    UNTIL YORD<YMIN;
    WRITE(PRINTER,CHR(NEXTFORM))
  END;

PROCEDURE FRAME;
BEGIN
  PENCOLOR(NONE); MOVETO(0,0);
  PENCOLOR(WHITE);
  MOVETO(0,YMAX); MOVETO(XMAX,YMAX);
  MOVETO(XMAX,0); MOVETO(0,0);
  PENCOLOR(NONE);
END;
```

```
PROCEDURE ERASE;
BEGIN
  VIEWPORT(0,XMAX,0,YMAX);
  FRAME;
  VIEWPORT(1,XMAX-1,1,YMAX-1);
   FILLSCREEN(BLACK);
   PENCOLOR(NONE);
   MOVETO(XMID,YMID);
   PENCOLOR(WHITE)
 END;

 PROCEDURE GRAFRANDOM;
 VAR YVAL:0..191;
     XVAL:0..279;
     RNDCOUNT:0..279;
 BEGIN
   ERASE;
   PENCOLOR(NONE);
   MOVETO(XMAX,YMID);
   PENCOLOR(WHITE);
   MOVETO(0,YMID);
   RNDCOUNT:=0;
   FOR XVAL:=0 TO 279 DO
     BEGIN
       IF RANDOM>16384 THEN RNDCOUNT:=RNDCOUNT+1;
       YVAL:=RNDCOUNT*191 DIV (XVAL+1);
       MOVETO(XVAL,YVAL)
     END;
END;


PROCEDURE DRAWSQUARE(I:INTEGER);
VAR J:1..4;
BEGIN
  FOR J:=1 TO 4 DO
    BEGIN
      MOVE(I);
      TURN(90)
    END
END;
```

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CIRCLE 152 ON READER SERVICE CARD

MX-80 Graphics, continued...

```
PROCEDURE DRAWFAN;
VAR I:1..36;

BEGIN
  ERASE;
  FOR I:=1 TO 36 DO
    BEGIN
      DRAWSQUARE(40);
      TURN(10)
    END;
  WAIT(3000)
END;


PROCEDURE DRAWSPIRAL;
VAR I:1..36;


    J:9..44;
BEGIN
  ERASE;
  FOR I:=1 TO 36 DO
    BEGIN
      J:=I+8;
      DRAWSQUARE(J);
      TURN(10)
    END;
  WAIT(3000)
END;

PROCEDURE STUFF(VAR BITMAP: PICTURE; S:STRING);
(* MAKE BUTTERFLY BITMAP FORM STRINGS *)
VAR J: INTEGER;
BEGIN
  FOR J:=1 TO LENGTH(S) DO
    BEGIN
      BIT:=(S[J]<>' ');
      BITMAP[ROW,J+59]:=BIT;
      BITMAP[ROW,60-J]:=BIT; (* SYMMETRIC *)
    END;
  ROW:=ROW-1;
END;


PROCEDURE BUTTER1;
BEGIN
  ROW:=53;
STUFF(BUTTER,'                       XX                 XXXXXXXXXXX       ');
STUFF(BUTTER,'                      XXX          XXXXXXXXXXXXXXXXXXXXX    ');
STUFF(BUTTER,'        XXXXXXXXXXXXXXXX        XXXXXXXXX              XX   ');
STUFF(BUTTER,'      XX                     XXXXXXX                     X  ');
STUFF(BUTTER,'    XX                    XXXXXXX                         X ');
STUFF(BUTTER,'   X                    XXXXXXX                           X ');
STUFF(BUTTER,'  X                   XXXXXX                              X ');
STUFF(BUTTER,'XX                 XXXXXXX                               *X ');
STUFF(BUTTER,' XX              XXXXXX                           ----- * X ');
STUFF(BUTTER,' X X           XXXXX                           ----      XX ');
STUFF(BUTTER,' XXX         XXXXX                           ---       * X  ');
STUFF(BUTTER,' XX        XXXXX                           ---       ** XX  ');
STUFF(BUTTER,' X       XXXX                             ---       * * X   ');
STUFF(BUTTER,'  X    XXXX                         ----------     *** XX   ');
STUFF(BUTTER,'   X   XXX               --      ---------   --   *** XX    ');
STUFF(BUTTER,'    X  XX            -----     -----           - * * XX     ');
STUFF(BUTTER,'X  XXX          ------      ----                 ** XX      ');
END;


PROCEDURE BUTTER2;
BEGIN
STUFF(BUTTER,' X  X         ---        ------------          ****XX       ');
STUFF(BUTTER,' X  X     -----       ---           ---      **** X         ');
STUFF(BUTTER,' X  X ----------------                -       ***XX         ');
STUFF(BUTTER,' X  X-----    ---    ---                -   **  * X         ');
STUFF(BUTTER,' X  X---                -                  ****  XX         ');
STUFF(BUTTER,'    X*  ---               -                *****X           ');
STUFF(BUTTER,'   X  **                                 ****** XX          ');
STUFF(BUTTER,'XXX  XX** *                             ******  X           ');
STUFF(BUTTER,'   X   XX***                             ***** XX           ');
STUFF(BUTTER,'   XXI  XX ***                       ***  ***  X            ');
STUFF(BUTTER,'XXX X I   XX** ****                  ***** *  XX            ');
STUFF(BUTTER,'   X X II   XX **** ** **  *  *  ***  *****   X             ');
STUFF(BUTTER,'   X X  II    XX ******** *** ** ***** ****  XX             ');
STUFF(BUTTER,'   X X  I I    IXX*  ************ ***** **   X              ');
STUFF(BUTTER,'XXXX  X  II     I XX ***** ******  *****    XX              ');
STUFF(BUTTER,'    X X  I I     I  XX      ****** ****    XX               ');
END;
```

```
PROCEDURE BUTTER3;
BEGIN
STUFF(BUTTER,'    X X  III      IIIIXXX       ***        XX           ');
STUFF(BUTTER,'    X  X  I I      I   II XXX             XX            ');
STUFF(BUTTER,'XXXX   X   III     I    II   XXXX       XX              ');
STUFF(BUTTER,'    XX X   I I       I  O  I    XXXXXXXXX               ');
STUFF(BUTTER,'    XX  X    II      I  OO  I   X  XXXX                 ');
STUFF(BUTTER,'    XX  X  I  I     II   OOO I   X                      ');
STUFF(BUTTER,'XXXXXX  X  I   III  I  II O   I  X                      ');
STUFF(BUTTER,'    X X X  II  I  III   II  O I X                       ');
STUFF(BUTTER,'   X  X  X II  I   I  OO II O I X                       ');
STUFF(BUTTER,'XXXX   X X  I  I    I OO  I   IX                        ');
STUFF(BUTTER,'   X    XX  I  I  O I OO   I  I X                       ');
END;

PROCEDURE BUTTER4;
BEGIN
STUFF(BUTTER,'XXX      X  I  I OOO I      II  X                       ');
STUFF(BUTTER,'  X      X  I O I OO I  OO I    X                       ');
STUFF(BUTTER,' X        X I O I     I    I X                          ');
STUFF(BUTTER,'X         X  I  I  O  I   I  X                          ');
STUFF(BUTTER,'           X I  I  OO  III  X                           ');
STUFF(BUTTER,'            X IIII    I     X                           ');
STUFF(BUTTER,'             X    I   I XXXX                            ');
STUFF(BUTTER,'              XXXXXIII X                                ');
STUFF(BUTTER,'                   X  X                                 ');
STUFF(BUTTER,'                    XX                                  ');
END;


PROCEDURE INITBUTTERFLY;
BEGIN
  BUTTER1;
  BUTTER2;
  BUTTER3;
  BUTTER4;
END;


PROCEDURE FLUTTER;
BEGIN
  (* DRAW SIX BUTTERFLIES *)
  DRAWBLOCK(BUTTER,16,0,0,120,54, 10,  0,14);
  DRAWBLOCK(BUTTER,16,0,0,120,54,150, 64,14);
  DRAWBLOCK(BUTTER,16,0,0,120,54, 10,128,14);
  DRAWBLOCK(BUTTER,16,0,0,120,54,150,128,14);
  DRAWBLOCK(BUTTER,16,0,0,120,54, 10, 64,14);
  DRAWBLOCK(BUTTER,16,0,0,120,54,150,  0,14);
  WAIT(1000);
END;

PROCEDURE ERRORMESSAGE(ERRPOINT:INTEGER);
BEGIN
 IF GRAFERROR THEN
  CASE ERRPOINT OF
    1:WRITELN('SORRY- NO BUTTERFLIES');
    2:WRITELN('SORRY- NO COMPRESSED BUTTERFLIES');
    3:WRITELN('SORRY- NO FAN');
    4:WRITELN('SORRY- NO SPIRAL');
    5:WRITELN('SORRY- NO RANDOM WALK');
    6:WRITELN('SORRY- NO COMPRESSED RANDOM WALK');
  END;
END;

BEGIN
  RANDOMIZE;
  REWRITE(PRINTER,'PRINTER:');
  INITBUTTERFLY;
  INITTURTLE;
  FRAME;
  FLUTTER;
  DRAW(0,159,0,191);
  ERRORMESSAGE(1);
  DRAW(0,263,0,191);
  ERRORMESSAGE(2);
  DRAWFAN;
  DRAW(50,209,0,191);
  ERRORMESSAGE(3);
  DRAWSPIRAL;
  DRAW(60,219,0,191);
  ERRORMESSAGE(4);
  GRAFRANDOM;
  DRAW(0,159,0,191);
  ERRORMESSAGE(5);
  DRAW(0,263,0,191);
  ERRORMESSAGE(6);
END.
```

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Each character is formed in an area of 8 x 8 pixels. Each row of eight pixels (bits) forms one byte, so that every character is defined by eight bytes.

Figure 1 shows one example of a character and the bytes that define it. After its formation, the definition of the character is stored sequentially, as demonstrated in Figure 2.

Note that even though each character definition is eight bytes long, once it is located properly, it can be recalled by its assigned ASCII code (128-254), which is only one byte long.

Making Characters

The screen display for the character generator shows four major sections. The second line of text displays the current memory location of the character set you are making or revising (in the format of segment: offset). The large 8 x 8 grid is where characters are actually designed. It represents the 8 x 8 pixels that make up the character space.

To its right, a box displays the ASCII codes of the characters in hexadecimal. The first digit of the code is given by the column heading, and the second digit by the row heading. The last section is the command table at the bottom of the screen.

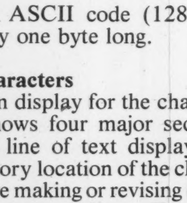
There is a total of 14 commands to help you design shapes. To use a command, simply type the first letter of that command. For example, if you wish to execute the command MEMORY, type the letter M. This first letter of the current command is shown to the lower left of the grid and remains until you change your command.

Before you begin to create shapes, be sure to indicate the memory location for the character set you want to make. To do this, use the MEMORY command, specifying the Segment and the Offset.

Be careful in using this command because doing so carelessly can "hang" the machine. (The CTRL-ALT-DELETE sequence may be inactivated.) Bad places to assign this location would be in the Basic work area (which could destroy the program), the system work area or BasicA program (both of which could "hang" the system), and the ROM (which would simply not let you create a character set). This is why it is recommended that you have 96K or more RAM.

With less than 96K, you must find a safe place in the Basic work area that does not interfere with program variables, the program, or system variables.

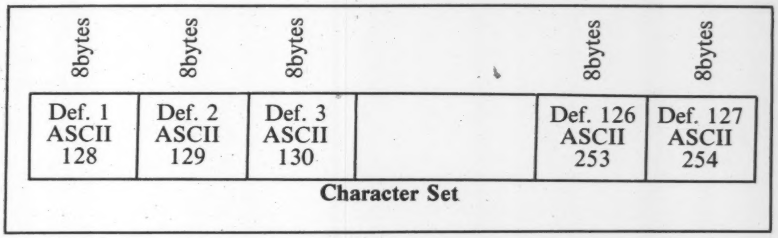
Figure 1.



Binary		Hex	Byte
00011000	=	18	1
00111100	=	3C	2
01100110	=	66	3
11000011	=	C3	4
11000011	=	C3	5
01100110	=	66	6
00111100	=	3C	7
00011000	=	18	8

C. Kenneth Fan, 4074 Koko Dr., Honolulu, HI 96816.

Figure 2.



Once you have found a safe location, you must tell the computer by giving it the segment location and offset. If you wish, you may type in a hexadecimal number by preceding it with &H.

The first four commands are UP, DOWN, LEFT, and RIGHT. Execution of these commands moves the cross hair on the grid in the specified direction. If you move the cross hair off a side of the grid, it will simply wrap around to the opposite side.

The next two commands, PLOT and ERASE, allow you to draw the character on the grid. To put a point on the grid, move the cross hair to the desired pixel location and type P for PLOT. Your character now has a point in this position. If you decide you no longer need a point, move the cross hair to the point you wish to erase and type E for ERASE. The point will disappear.

When you are done making a shape, you store it as a character by using the FINISHED command (type F). The computer then asks for your ASCII code for the character. This code must be between 128 and 254 (&H80-&HFE). After you type this number, the computer pauses a moment and then displays your character in the character set in the box on the right in the position designated by your ASCII code. If you do not want to keep the character, you can clear the grid at any time by typing C for CLEAR.

The GET command is the opposite of FINISHED. It takes a character from the character set and puts it into the grid. This can be used for revising an already existing character or for adding something (such as an underline) to it. When you execute the GET command, the computer asks for the ASCII code just as it does for the FINISHED command. It then asks whether you wish to merge the character or not. If you wish to merge (combine the character you asked for and the shape already in the grid), type Y.

The next four commands, ACCESS, SAVE, MEMORY, and NEW, affect the whole character set as opposed to a single character. The NEW command wipes out the character set. It CLEARs all characters from RAM, but not from disk. The MEMORY command is used to change the memory location of the character set, as described above.

The ACCESS and SAVE commands allow you to load from and save to disk respectively. The ACCESS command leads the character set under the specified filename at the current memory address. The SAVE command saves the current character set under the specified filename.

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PC Characters, continued...

The last command, QUIT, simply ends the program. To prevent loss of your character set accidentally, the QUIT command asks if you are sure you want to quit.

Using the Characters in Other Programs

To use the characters made by the IBM PC Character Generator in your own program, type the instructions in Listing 1, either directly into RAM or as part of your program. This example assumes that your special character set will be loaded at memory location 1700:0, and is named GREEK.CHR.

Remember that the characters can be used only in a graphics mode. For 80 columns, use screen two (640 x 200); for 40 columns, use screen one (320 x 200). The characters will be displayed in the foreground color. If you wish to change this color, you can always use the BASICA PAINT command to fill the character. In 80 column mode you are stuck with black and white.

To type one of your characters, simply hold down the CTRL and ALT keys and type the three digit ASCII number in decimal of the desired character. For example, to get character 143, use this sequence: CTRL-ALT-1-4-3.

You can now use your custom made character set. □

Listing 1.

```
10 DEF SEG=0                'Set the segment to 0'
20 POKE &H7F,&H17           'High byte of segment of characters
30 POKE &H7E,&H00           'Low byte of segment of characters'
40 POKE &H7D,&H00           'High byte of offset of characters'
50 POKE &H7C,&H00           'Low byte of offset of characters'
60 DEF SEG=&H1700           'Set segment of desired character
                              segment location'
70 BLOAD "GREEK.CHR",0      'Load character set with offset'
```

Listing 2.

```
90 '
100 SCREEN 1:CLS:OUT 980,2:OUT 981,44
110 KEY OFF:LOCATE 1,2:DEF SEG=0
120 DIM C%(50)
130 LINE (150,100)-(170,100):LINE (160,95)-(160,105)
140 GET (150,95)-(170,105),C%
150 CLS:XPOS=4:YPOS=4
190 PRINT "Character Generator I  By C. Kenny Fan"
200 GOSUB 10000
210 GOSUB 11000
220 GOSUB 12000
230 PUT (XPOS*25+22,YPOS*15+22),C%
235 S=PEEK(&H7F)*256+PEEK(&H7E):O=PEEK(&H7E)
*256+PEEK(&H7C)
240 A$=INKEY$:IF A$="" THEN 240
245 LOCATE 18,1:PRINT A$
250 PUT (XPOS*25+22,YPOS*15+22),C%
300 IF A$="M" OR A$="m" THEN 1000
310 IF A$="U" OR A$="u" THEN YPOS=YPOS-1:IF YPOS<0
THEN YPOS=7
320 IF A$="D" OR A$="d" THEN YPOS=YPOS+1:IF YPOS>7
THEN XPOS=7
330 IF A$="L" OR A$="l" THEN XPOS=XPOS-1:IF XPOS<0
THEN XPOS=0
340 IF A$="R" OR A$="r" THEN XPOS=XPOS+1:IF XPOS>7
THEN YPOS=0
350 IF A$="P" OR A$="p" THEN CIRCLE (XPOS*25+33,
YPOS*15+27),9,,,,3/5:PAINT (XPOS *25+33,YPOS*15+27)
360 IF A$="E" OR A$="e" THEN PAINT (XPOS*25+33,
YPOS*15+27),0,0
370 IF A$="Q" OR A$="q" THEN 2000
380 IF A$="C" OR A$="c" THEN 150
390 IF A$="F" OR A$="f" THEN 3000
400 IF A$="S" OR A$="s" THEN 4000
410 IF A$="A" OR A$="a" THEN 5000
420 IF A$="G" OR A$="g" THEN 6000
430 IF A$="N" OR A$="n" THEN 7000
999 GOTO 230
1000 LOCATE 21,1:INPUT "Segment : ",A
1005 IF A<0 THEN A1=A+65536! ELSE A1=A
1010 LOCATE 21,1:GOSUB 16000
1020 INPUT "Offset : ",O
1025 IF O<0 THEN O=O+65536! ELSE O1=O
1030 POKE &H7F,A1/256:POKE &H7E,A MOD 256
1040 POKE &H7D,O1/256:POKE &H7C,O MOD 256
1050 LOCATE 21,1:GOSUB 16000:GOSUB 10000:GOTO 230
2000 LOCATE 21,1:PRINT "Quit (Y/N) ?"
2010 GOSUB 15000
2020 IF A$="Y" OR A$="y" THEN CLS:PRINT "BYE!":END
2030 LOCATE 21,1:GOSUB 16000:GOTO 230
3000 LOCATE 21,1:INPUT "ASCII code (128-254) : ",A
3010 IF A<128 OR A>254 THEN BEEP:GOTO 3000
3020 LOCATE 21,1:GOSUB 16000
3040 DEF SEG=S
3050 A=A-128:FOR I=0 TO 7
3055  Z=0
3060  FOR X=33 TO 208 STEP 25
3070   IF POINT (X,I*15+27)=3 THEN Z=Z+2^(7-(X-33)/25)
3080  NEXT:POKE O+A*8+I,Z
3090 NEXT
3100 DEF SEG=0:GOSUB 10000:GOTO 230
4000 DEF SEG=S
4020 LOCATE 21,1:INPUT "Filename : ",F$
4030 LOCATE 21,1:GOSUB 16000
4040 BSAVE F$,O,1024
4050 DEF SEG=0:GOTO 230
5000 DEF SEG=S
5020 LOCATE 21,1:INPUT "Filename : ",F$
5030 LOCATE 21,1:GOSUB 16000
5040 BLOAD F$,O
5050 DEF SEG=0:GOSUB 10000:GOTO 230
6000 LOCATE 21,1:INPUT "ASCII code (128-254) : ",A
6010 IF A<128 OR A>254 THEN 6000
6020 LOCATE 21,1:GOSUB 16000
6025 PRINT "Merge the character (Y/N) ?":GOSUB 15000
6028 LOCATE 21,1:GOSUB 16000
6050 DEF SEG=S
6060 FOR Y=0 TO 7
6070  B=PEEK(O+(A-128)*8+Y)
6080  FOR X=0 TO 7
6090   IF B AND 2^(7-X) THEN CIRCLE (25*X+33,Y*15+27)
,9,,,,3/5:PAINT (X*25+33,Y* 15+27) ELSE IF A$<>"y"
AND A$<>"Y" THEN PAINT (X*25+33,Y*15+27),0,0
6100  NEXT
6110 NEXT:DEF SEG=0:GOTO 230
7000 LOCATE 21,1:PRINT "New: are you sure? (Y/N)"
7010 GOSUB 15000:LOCATE 21,1:GOSUB 16000
7020 IF A$="Y" OR A$="y" THEN DEF SEG=S:FOR I=O
TO O+1023:POKE I,0:NEXT:DEF SEG=
0:GOTO 150
7030 GOTO 230
10000 LOCATE 3,32:PRINT "89ABCDEF"
10010 A$="0123456789ABCDEF"
10020 FOR VTAB=4 TO 19
10030  LOCATE VTAB,31:PRINT MID$(A$,VTAB-3,1);
10040 LOCATE VTAB,40:PRINT MID$(A$,VTAB-3,1);
10050 NEXT
10060 LOCATE 20,32:PRINT "89ABCDEF"
10070 FOR I=128 TO 255
10080  LOCATE I MOD 16+4,INT(I/16)+24
10090  PRINT CHR$(I);
10100 NEXT
10105 LOCATE 2,2:PRINT "Character set location:
"HEX$(PEEK(&H7F)*256+PEEK(&H7E))
":"HEX$(PEEK(&H7D)*256+PEEK(&H7C))"
10110 RETURN "
11000 LOCATE 22,1
11020 PRINT "U)p  D)own  L)eft  R)ight  P)lot
E)raseF)inished  G)et a character
S)ave set  A)ccess  M)emory  C)lear  N)ew  Q)uit";
11030 RETURN
12000 FOR I=0 TO 8:LINE (I*25+20,20)-(I*25+20,140)
:LINE (20,I*15+20)-(220,I*15+2
0):NEXT
12010 RETURN
15000 A$=INKEY$:IF A$="" THEN 15000 ELSE RETURN
16000 PRINT SPACE$(30);:LOCATE ,1:RETURN
```

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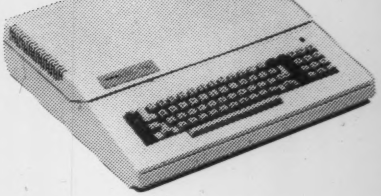

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Part 1

This is the first of a three-part series on graphics creation for purposes such as doodling, making limited resolution artwork, and designing graphics for your own programs.

The programs are intended to simplify graphics creation for the above purposes, and should be of interest to novice and expert computer users.

This article describes an etch-a-sketch program that I call Sketch/Print. The second article describes a program, called Vector Plotter, which draws lines between any two points on the screen that you specify. The last article describes a program, Graphics Manager, which stores whatever is on the screen. Graphics Manager can store up to nine pictures, which I call frames, that can have either standard or double width characters. Using Graphics Manager, frames can be saved on tape, loaded from tape, compressed, printed on paper, combined, and have the ASCII number of every byte in them listed.

Sketch/Print and Vector Plotter can be used independently, or you can add Graphics Manager to either. I recommend that you type them as shown alone, test them individually, and correct your typographical errors, and then if you desire, follow the instructions in Part 3 of this series to add Graphics Manager to one or both of the others.

Programmers who have more than 16K of free RAM may want to combine all three programs. That is a fairly simple task if you know Basic well, have about 18K of free RAM, and have an excellent line renumbering program.

John Crew, 1106 Karin Dr., Normal, IL 61761.

John Crew

System Requirements

All of the programs in this series are written in Level II Basic for an unmodified Model I, 16K, cassette system. All programs except Graphics Manager will easily fit into 4K of free RAM. Using Graphics Manager with one of the other programs requires at least 16K of free RAM, and it is a tight fit so there probably is not enough room for anything else except a very short program such as a simple key debounce program.

To print frames on paper using Graphics Manager you need an MX-80 printer (the basic model without the new features is adequate), or you will have to modify the program. The article on Graphics Manager will describe how frames are stored, which should be very helpful to those who want to modify the program.

Because I used POKE statements and some other tricks which are unique to the previously described system, the programs in this series will probably require modifications to work on a Model III, a differently configured Model I, or other computer.

I spent many hours developing and debugging the programs in this series so I do not think they contain any errors. The programs have many tests to reject clearly erroneous commands. The only problem I am aware of is that some parts of the programs are not written in the most efficient and neat manner. There are no syntax errors, so do not change any statements which look wrong to you. If you find statements which you think are unnecessary, please leave them alone; there is probably a good reason for their inclusion.

One good book which helped me gain the skills and knowledge which I needed to write these programs was William Barden's *Programming Techniques for Level II Basic* which is sold by Radio Shack. I highly recommend that book to intermediate Basic programmers who want to become more versatile.

Program Modification

The three main programs are written very compactly to save memory space and execution time. To this end I willingly sacrificed some legibility and ease of comprehension. For Basic programs they are rather fast. They could be made even faster if you rewrote them so the subroutines were put as close to the beginning as possible with the most frequently used subroutines first.

Another way to make the programs run faster if you have memory in the expansion interface is to set the memory size to 32769 so Basic will use the faster RAM in the keyboard. When you type them, omit all REM statements.

I strongly urge you to learn about the EDIT mode of Level II Basic before typing any program which has long lines since that knowledge will probably save you much frustration. Where you see what appears to be a long string of blanks, in the program I have used the ↓ key to start a new line on the screen; there are no long strings of blanks in my programs because they waste space and formatted output is better produced with STRING$ or TAB in a PRINT statement, or, of course, PRINT USING.

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CIRCLE 127 ON READER SERVICE CARD

TRS-80, continued...

I used many tricks to save memory, some of which I have rarely or never seen used before. For example, there are only two cases in which a semicolon is needed in a PRINT statement: at the end of a PRINT statement to suppress a line advance, and to indicate the separation of two variable names. Many people use unnecessary semicolons in PRINT statements.

Figure 1 gives examples of compact PRINT statements which are designed to print the current values of two variables named A and B. Notice in particular that the first example will not work as intended; it will print a single value which is the value of a variable named AB if such a variable is used in the hypothetical main program. If AB is not used elsewhere, Level II will set aside space for AB and set its value to zero. Also notice that putting a space between the A and the B will not affect that PRINT statement, because Level II Basic almost always ignores spaces in statements. The other examples will properly print two values.

About Sketch Print

Most of the etch-a-sketch programs which I have seen range in quality from mediocre to dreadful. I decided to write a better program which would use a small graphics block instead of a large graphics character, which was compact and efficient, and which did not behave oddly when the edge of the screen was reached.

Sketch/Print can work in two different ways (modes): graphics mode and alphanumeric mode. When you run it, you will first see the instructions. Next you will see a small graphics block at the lower lefthand corner of the screen. When that block appears, you are in the graphics mode.

The Graphics Mode

In the graphics mode you can move the cursor using the keys 1-9 on the numeric keypad (or the numeric keys on the main keyboard) in a pseudo-joystick fashion. The 8 key moves the cursor straight up, the 9 moves it diagonally upward to the right, the 6 moves it to the right, etc.

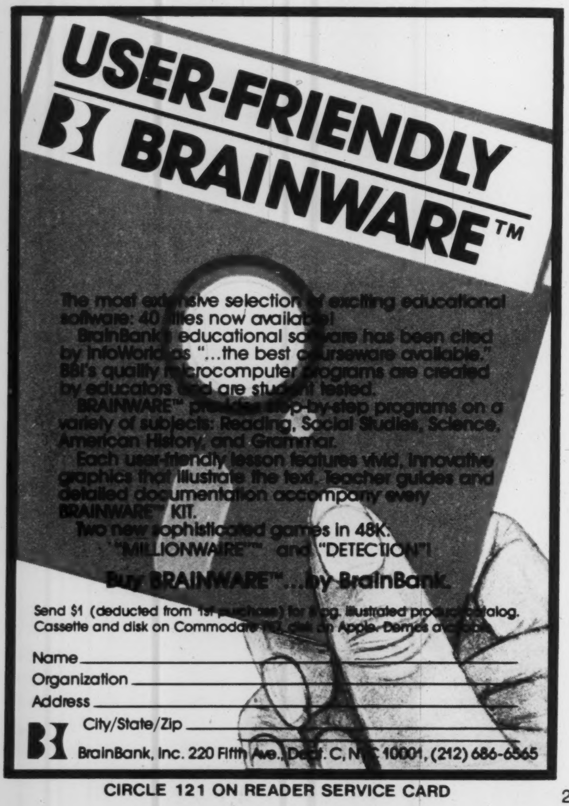
Using the 5 key, you can turn on a graphics block at the current cursor location. The other keys (1-3, 4, 6, 7-9) first move the cursor and then turn on a graphics block. The keys in the numeric keypad will repeat as long as you hold them down. If you find the rate of repetition too fast, increase the value assigned in line 380 to the variable named T and insert this at the beginning of line 350:

T=#:GOSUB410:

(using a digit in place of #).

Figure 1. Examples of Compact PRINT Statements.

Compact Form	Functionally Equivalent Form	Separator of Variable Names
PRINTAB	PRINTA B	none
PRINTA;B	PRINT A; B	;
PRINTA%B	PRINTA% B	%, type declaration character
PRINTA" AND "B	PRINT A " AND " B	literal character string
PRINTASIN(C)B	PRINT A SIN(C) B	function name
PRINTATAB(10)B	PRINT A TAB(10) B	Basic keyword



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Did you know we send out twenty thousand or more sales bulletins every two months?

Did you know that our sales are probably the best sales you've ever seen? Last month we sold the Elephants at an introductory price, the people who got the sales bulletins were able to buy them a month before the rest of the country.

One of the items in the current sale is ribbon cartridges (not just refills) for the MX-80 at **$4.99** each, MX-100 **$14.99.**

How do you get on the mailing list? There's only one way. That's to place an order. Requesting a catalog won't do it. But, once you buy from us, you're stuck on our mailing list.

Future sale flyers will contain fabulous bargains, both old and new items.

So, to entice you to want to get on the mailing list, there are some super specials listed elsewhere in this page.

SUPER-DUPER JOYSTICKS

Last month Barb ordered me a Wico joystick for evaluation without telling me first. When it came in I couldn't believe it. It is the most substantial joystick for the Atari I've ever seen. It's made by the same people who make the ones for the commercial arcade games. Made for the Atari, they will work with the Apple with an adaptor or the Joyport. There's also a fancier model with a chrome shaft and red ball on top. They also make a trackball controller that will blow your mind.

#160	**Command Controller** ($29.95) now	**$24.44**
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#162	**Trackball** ($69.95) now	**$54.44**

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VERBATIM CLEANING KIT - $5.00

Here's a loss-leader that we hope will entice you to buy from us. When you make any purchase, you can but a $12.95 Verbatim cleaning kit for only $5.00. One to a customer or family, only while supply lasts. When this ad was written, there were 400 on the way to us. So, when these are gone, that's it. Order stock #4012.

GENERIC COMPUTER GAMES

We're revolting! Whoops, I mean we're revolting against high prices in computer games. As part of our effort, we are publishing the only Generic Computer Games in the world. Originally costing $14.95 each, I've taken Skeet Shoot, Trap Shoot (both HIRES) and put them on one disk along with a picture of Great Grandma Huntington.

They are two of the first games ever produced by a very famous software company. I bought the rights for them for $200 and decided to have some fun with them.

Made for the Apple, they come complete with a yellow documentation page, reminiscent of what you would find in your local supermarket. (After all, our shipping warehouse was at one time a supermarket.) Order #9008 for only **$9.99.**

WURST OF HUNTINGTON

We're still getting rave notices about the Wurst of Huntington. People are amazed at how we cut the price of Wurst from $19.99 to **$9.99.** Once they see the program, however, they understand.

One customer wrote us saying that the Wurst was a tribute to beginning programmers all over the world who would like to sell their programs. Another praised us saying Wurst was everything we promised.

So, if you want the worst eight programs ever assembled on one disk (and have a little fun, too), order #9010 for **$9.99.**

COMPUTER ALMANAC

We think that Computer Almanac, written by Dave Carman is a good buy. It's a weather predicter, a loan amortization program, and a wealth of general knowledge. Order #9014 for **$24.99.**

UNDERSTAND YOURSELF

Written by Mike Taylor, Understand Yourself is a series of tests to help you get a better psychological insight of yourself. Not meant to be a clinical substitute, Understand Yourself is fascinating and will keep you and your mate intrigued for hours. Order #9012 for **$24.99.**

Here's something new for all you Epson MX-80 and MX-100 lovers — the MXPLUS. This amazing gadget allows you to use your printer buttons to instantly select the print mode you want.

For instance, press the "on line" button three times and you have instant double size print. Press twice and you have condensed print. No soldering, cutting or drilling. Easy to install. Does not interfere with normal operation of printer or software. Our price **$44.99.**

Great Grandma Huntington Cared

INTEGER FIX, ETC.

Here's an easy-to-use program that will covert your Integer programs to Applesoft in nothing flat. #9543. **$19.99.**

We also carry the complete line of Market software including Tennis Draw, League Schedule, Long Term Reservations, Swim Meet, League Standings and more. Call for prices.

We also have Masterworks, Nutricalc, Execuware, PCP, Thesis, and much, much more.

Here's a special to catch before the price increase. We're selling Advance Access disk boxes ($24.95 list before price increase) for **$21.99.** Buy two or more and you can have them for **$19.99** each. These are super storage boxes and will hold up to 90 disks each. I have five of them at home.

We've got Pac-Man Ghost pins for $2.50, Super-Fan II for $59.00, Master Diagnostics Plus - for $55.00, Mail Ordering program $5.00, and Verbatim disks 10/$25.99 with a plastic carrying case.

STREET LIFE

We now carry Street Life, as featured in Play Boy. We don't recommend this for everyone and will not sell it to you if we even suspect you are under the age of twenty-one. Warning, some people may find the theme and language offensive. Our price, **$26.99.**

ATARI ATARI ATARI ATARI ATARI ATARI

Our collection of Atari games continues to grow. My personal favorite now is Frogger. Until Jan. 30 you can have this $34.95 game for only **$19.94** when you purchase any other item. Please specify cassette or disk. The graphics and sound on this program are superb.

Airstrike by English Software is a new game that has been very popular overseas. It only takes 16K and comes in cassette and disk versions. If you're bored by ordinary arcade-type games, Airstrike will present an enormous challenge to you. List price is $39.95. Until Jan. 30 you can have it for **$29.94.**

THANK YOU

Thank you to the many well-wishers on the birth of our son, Dale. He is very healthy and doing well. He's learning the computer business from the ground up. He's by Barb's desk every day. I'm sure many of you have heard him in the background when you call. You should see Barb trying to take an order over the telephone, punch numbers into the computer and nurse Dale, all at the same time.

One last item, we have a spiffy new lower case chip that's made for us locally. For a short time we are selling it for only **$15.00.** I wanted to call it the Buffalo Chip but I got out-voted. So, for $15.00 be sure to order the GGH lower case chip. (Can you guess what GGH stands for?)

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CIRCLE 281 ON READER SERVICE CARD

Painless Graphics, continued...

Listing 1. Characters Allowed in Alphanumeric Mode of SKETCH/PRINT.

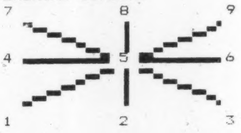
```
10 CLS: PRINT "CHARACTERS WHICH CAN BE PRINTED IN THE ALPHANUMERIC MODE OF": PRI
NT "SKETCH/PRINT
20 DATA 32, 64, "BLANK SPACE, NUMERALS, AND SOME COMMON NONALPHABETIC SYMBOLS"
30 DATA 65, 90, UPPER CASE ALPHABET
40 DATA 91, 91, UPWARD ARROW
50 DATA 97, 122, LOWER CASE ALPHABET (CONVERTED TO UPPER CASE)
60 CLEAR50: DEFINTA-Y: DEFSTRZ
70 FOR I=1 TO 4: READ B, C, Z: PRINT: PRINT: PRINTZ
80   FOR J=B TO C: PRINT CHR$(J)" ";: NEXT
90 NEXT
99 GOTO 99
```

Listing 2. Example of SETting a Point in a Location Occupied by an Alphanumeric Character.

```
10 CLEAR 50: CLS: DEFINT X: DEFSTR A-B: A="THIS IS A TEST"
20 PRINT A: PRINTA: PRINT@ 960, "PRESS ANY KEY EXCEPT 'BREAK' TO CONTINUE.";
30 B=INKEY$:IFB=""THEN30
40 FOR X=0 TO 15: SET(X,5): NEXT
45 PRINT@ 960, CHR$(31);: REM  THIS STATEMENT ERASES THE SCREEN FROM POSITION #
960 TO 1023 (THAT IS, IT ERASES THE LAST LINE).
50 PRINT@ 896, "NOTICE THAT PART OF THE SECOND LINE WAS ERASED WHEN IT WAS
UNDERLINED.";
60 GOTO 60
```

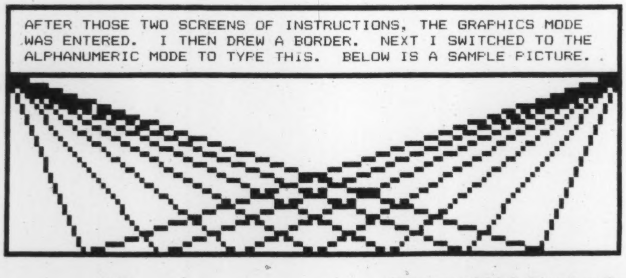
Sample RUN of SKETCH/PRINT.

```
              SKETCH/PRINT BY JOHN CREW 12/24/81
                        GRAPHICS MODE
USE NUMERIC KEYPAD TO MOVE CURSOR AS SHOWN IN DIAGRAM.
USE THOSE KEYS WITH THE SHIFT KEY TO ERASE.
PRESS '.' TO SWITCH TO NONDESTRUCTIVE FLASHING CURSOR.
PRESS 'SHIFT .' TO RETURN TO NORMAL
CURSOR.
PRESS 'SHIFT ←' TO SWITCH TO
ALPHANUMERIC MODE.
PRESS 'S' TO STORE CURSOR LOCATION.
PRESS 'D' TO AUTOMATICALLY DRAW A
LINE FROM THE STORED LOCATION TO THE
PRESENT LOCATION.
PRESS 'E' TO DO SAME AS 'D' BUT ERASE.
```



```
         PRESS ANY KEY BUT 'BREAK' TO CONTINUE
```

```
                    ALPHANUMERIC MODE

ALL PRINTABLE KEYBOARD CHARACTERS BUT LOWER CASE MAY BE USED.
PRESS '←' TO BACKSPACE AND ERASE LAST CHARACTER.
PRESS 'SHIFT →' TO RETURN TO GRAPHICS MODE.

                       BOTH MODES

PRESS 'SHIFT CLEAR' TO ERASE THE SCREEN.
PRESS 'ENTER' TO GO TO GRAPHICS MANAGER (IF IT HAS BEEN ADDED).



         PRESS ANY KEY BUT 'BREAK' TO CONTINUE
```



```
AFTER THOSE TWO SCREENS OF INSTRUCTIONS, THE GRAPHICS MODE
WAS ENTERED.  I THEN DREW A BORDER.  NEXT I SWITCHED TO THE
ALPHANUMERIC MODE TO TYPE THIS.  BELOW IS A SAMPLE PICTURE.
```

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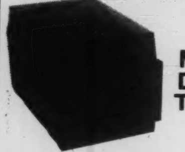

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Painless Graphics, continued...

Listing 3. SKETCH/PRINT

```
100 CLEAR2:DEFINTA-Z:DIMID(8)
105 REM ** LINES 110-150 PROVIDE INSTRUCTIONS
110 CLS:PRINTTAB(13)"SKETCH/PRINT BY JOHN CREW 12/24/81
"TAB(24)"GRAPHICS MODE
USE NUMERIC KEYPAD TO MOVE CURSOR AS SHOWN IN DIAGRAM.
USE THOSE KEYS WITH THE SHIFT KEY TO ERASE.
PRESS '.' TO SWITCH TO NONDESTRUCTIVE FLASHING CURSOR.":QA$="ALPHANUMERIC MODE"
120 QA$="ALPHANUMERIC MODE":PRINT"PRESS 'SHIFT .' TO RETURN TO NORMAL
CURSOR.
PRESS 'SHIFT "CHR$(93)"-' TO SWITCH TO
"QA$".
PRESS 'S' TO STORE CURSOR LOCATION.
PRESS 'D' TO AUTOMATICALLY DRAW A
LINE FROM THE STORED LOCATION TO THE
PRESENT LOCATION.
140 PRINT"PRESS 'E' TO DO SAME AS 'D' BUT ERASE.":PRINT@358,7TAB(50)8TAB(61)9;:P
RINT@550,4TAB(61)6;:FORY=18TO33:SET(103,Y):NEXT:FORX=82TO122:Y=.370079*(X-38):SE
T(X,Y+2):SET(X,25):SET(X,49-Y):NEXT:PRINT@562,5;:PRINT@806,1TAB(50)2TAB(61)3;
145 GOSUB420:CLS:PRINTTAB(23)QA$"

ALL PRINTABLE KEYBOARD CHARACTERS BUT LOWER CASE MAY BE USED.
150 PRINT"PRESS '"CHR$(93)"-' TO BACKSPACE AND ERASE LAST CHARACTER.
PRESS 'SHIFT -"CHR$(94)"' TO RETURN TO GRAPHICS MODE.

"TAB(27)"BOTH MODES

PRESS 'SHIFT CLEAR' TO ERASE THE SCREEN.
PRESS 'ENTER' TO GO TO GRAPHICS MANAGER (IF IT HAS BEEN ADDED).":GOSUB420
153 REM ** END OF INSTRUCTIONS. THE MAIN PART OF THE PROGRAM FOLLOWS. LINES 155-
160 SET VARIABLES TO INTITIAL VALUES, CLEAR THE SCREEN, AND SET A GRAPHICS BLOCK
 IN THE LOWER LEFT-HAND CORNER
155 CLS
160 QA=0:X=0:Y=47:X1=X:Y1=Y:F=0:SET(X,Y):T=9:GOSUB410
165 REM ** LINE 170 ERASES PART OF THE KEYBOARD BUFFER SO THE COMPUTER DOESN'T K
NOW CERTAIN KEYS WERE PRESSED BEFORE
170 FORQE=0TO2:POKEQE+16442,0:NEXT
175 REM ** THE "PEEK" STATEMENT IN LINE 180 RETURNS A 1 IF THE "SHIFT" KEY IS DE
PRESSED, OTHERWISE IT RETURNS 0
180 S=PEEK(14464):QA$=INKEY$:IFQA$=""THEN180ELSEN=ASC(QA$)
183 REM ** LINE 185 CONTAINS TESTS TO INTERPET KEYBOARD INPUT IN THE GRAPHICS AN
D ALPHANUMERIC MODES. MOST OF THAT LINE IS USED FOR ONLY THE GRAPHICS MODE
185 IFS=1ANDN=31THEN155ELSEIFQATHEN190ELSEIFN=24THENQA=7ELSEIFN=83THENX1=X:Y1=YE
LSEIFN=68ORN=69THEN195ELSEIFN=46THENF=7:GOTO380ELSEIFN=62THENF=0:GOTO380ELSEIF32
<NANDN<58THENN=N+48*(48<N)+32*(N<42):IFN<10THEN210
187 GOTO170
189 REM ** LINES 190-193 ARE USED ONLY FOR PRINTING A CHARACTER AND MOVING THE C
URSOR IN THE ALPHANUMERIC MODE
190 IFN=25QA=0:GOTO180ELSEIFN=8THENIF1<XTHENX=X-2ELSEIF2<YTHENY=Y-3:X=X+126
192 T=FIX(Y/3)*64+FIX(X/2)+15360:IFN=8THENPOKET,32ELSEIF31<NANDN<128THENPOKET,N+
32*(N>95):IFX<126THENX=X+2ELSEIFY<45THENY=Y+3:X=X-126
193 GOTO180
194 REM ** LINES 195-200 DRAW OR ERASE A LINE AUTOMATICALLY. IF THE REQUESTED LI
NE IS HORIZONTAL OR IF THE INTITIAL AND TERMINAL POINTS ARE THE SAME, LINES 195-
196 ARE USED. OTHERWISE, ONE OF THE TWO LOOPS IN LINES 197-200 DRAWS OR ERASES T
HE LINE
195 S=(N=68):IFY1<>YTHEN197ELSEFORN=X1TOXSTEPSGN(X-X1)-(X=X1):IFSTHENSET(N,Y)ELS
ERESET(N,Y)
196 NEXT:GOTO180
197 A!=ABS((X-X1)/(Y-Y1)):IFA!>1THEN199ELSEA!=SGN(X-X1)*A!:B!=X1:FORN=Y1TOYSTEPS
GN(Y-Y1):IFSTHENSET(B!+.5,N)ELSERESET(B!+.5,N)
198 B!=B!+A!:NEXT:GOTO180
199 A!=SGN(Y-Y1)/A!:B!=Y1:FORN=X1TOXSTEPSGN(X-X1):IFSTHENSET(N,B!+.5)ELSERESET(N
,B!+.5)
200 B!=B!+A!:NEXT:GOTO180
205 REM ** THE FOLLOWING IS USED IN THE GRAPHICS MODE TO CHECK THE REQUESTED DIR
ECTION. ALSO, IF THE MOVEMENT IS LEGAL, THE CURSOR IS MOVED AND A GRAPHICS BLOCK
 IS SET, RESET, OR FLASHED. LINES 210-220 SET ILLEGAL DIRECTION FLAGS.
210 FORQE=0TO8:ID(QE)=0:NEXT:IFX=0FORQE=0TO6STEP3:ID(QE)=7:NEXTELSEIFX=127FORQE=
2TO8STEP3:ID(QE)=7:NEXT
220 IFY=0FORQE=6TO8:ID(QE)=7:NEXTELSEIFY=47FORQE=0TO2:ID(QE)=7:NEXT
230 REM ** LINE 250, IF THE REQUESTED MOTION IS ILLEGAL, THE COMPUTER GOES BACK
FOR ANOTHER COMMAND. IF THE DIRECTION IS LEGAL, THE CURSOR MOVEMENT IS PERFORMED
 BY THE LAST PART OF LINE 250 AND BY LINE 260
250 IFID(N-1)THEN170ELSEIFN<4THENY=Y+1ELSEIF6<NTHENY=Y-1
260 IFN/3=FIX(N/3)THENX=X+1ELSEIF(N+2)/3=FIX((N+2)/3)THENX=X-1
330 REM ** NOW THAT THE CURSOR HAS BEEN MOVED, A BLOCK WILL BE SET, RESET, OR FL
ASHED. IF THE FLASHING CURSOR IS ON, LINE 340 DIVERTS PROGRAM EXECUTION TO LINE
380
340 IFFTHEN380ELSEIFSTHENRESET(X,Y)ELSESET(X,Y)
350 GOTO170
360 REM ** LINES 380-400 FLASH THE CURSOR AND GO BACK FOR A NEW COMMAND
380 S=POINT(X,Y):T=1:FORQE=0TO2:IFSTHENRESET(X,Y)ELSESET(X,Y)
390 GOSUB410:IFSTHENSET(X,Y)ELSERESET(X,Y)
400 GOSUB410:NEXT:GOTO170
405 REM ** LINE 410 IS A DELAY SUBROUTINE. LINES 420-430 CONTAIN A SUBROUTINE WH
ICH WAITS FOR A KEY TO BE PRESSED
410 FORQF=0TO10*T:NEXT:RETURN
420 PRINT@971,"PRESS ANY KEY BUT 'BREAK' TO CONTINUE";
430 IFINKEY$=""THEN430ELSERETURN
```

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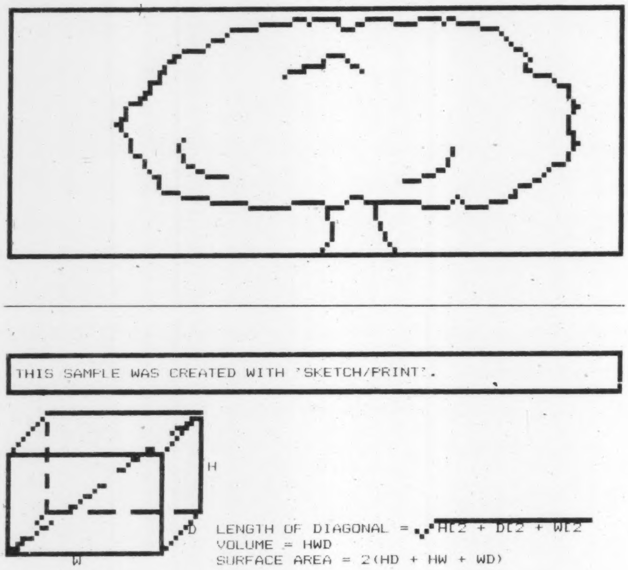
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H
D
W
LENGTH OF DIAGONAL = √H[2 + D[2 + W[2
VOLUME = HWD
SURFACE AREA = 2(HD + HW + WD)

Each time you press a key which moves the cursor, the direction is checked to be sure that it will not move the cursor off the edge of the screen. If the direction is illegal, then the cursor movement command is ignored.

Holding the SHIFT key down while a numeric key is depressed will erase instead of turn on a block.

To move the cursor to a different position without erasing or drawing over existing graphics, press the decimal point key. This will switch to a flashing cursor which will not disturb your graphics characters, but you will have to be careful not to move through or under an alphanumeric character (which will be mentioned later in detail). To return to the normal cursor for the graphics mode, press the decimal point and the SHIFT keys simultaneously.

You can also draw and erase lines automatically while in graphics mode. Press the S key to store the current cursor location for later reference when automatically drawing lines. To draw a line from the last stored location to the present location, press the D key.

To erase a line from the last stored location to the present cursor location, press the E key. The stored location is initially set to the coordinates of the lower lefthand corner of the screen.

Switching Modes

To switch to the alphanumeric mode, press the SHIFT key and the ← key. To return to graphics mode, press the SHIFT key and the →.

The Alphanumeric Mode

In the alphanumeric mode you may type on the screen any displayable character which is accessible from the keyboard except the lower case letters. Listing 1 displays the characters which may be used. Any lower case letter which you use will be converted to upper case. The left arrow key may be used to backspace and erase the last character. You cannot go beyond the top or bottom of the screen.

Restrictions

There are two restrictions imposed on the program by the design of the Model I.

The first restriction is that, as noted above, lower case letters can't be used in the alphanumeric mode. This is because the unmodified Model I has only seven instead of eight bits for each location in the video memory (bit 6 is not stored). You will see a character with an ASCII number 64 less than the one you POKEd if you POKE a character with an ASCII code of 96-127 or 192-255. If you POKE an ASCII value less than 32, you will see a character with an ASCII number 64 greater than the POKEd code.

Line 192 contains the POKE statement which puts an alphanumeric character into video memory and also converts lower case letters to upper case. If you have a working lower case modification, you may want to modify this program to allow lower case letters. I believe that the only change needed is to use the EDIT mode of Level II to delete +32*(N>95) from the second POKE statement in line 192.

The second restriction is that you can't move through or immediately under an alphanumeric character while you are in the graphics mode of Sketch/Print. This is because the Model I has character graphics instead of a separate display mode for graphics such as the Color Computer has.

On the Color Computer you could write a program to draw alphanumeric characters while in one of the high resolution graphics modes, so you could freely draw over the alphanumeric characters. But, alas, on the Model I you are restricted to the characters listed in the C appendix of the Level II reference manual.

The only way to make two characters on the screen appear to overlap is to flash them alternately at high speed, a trick which this program cannot accomplish.

There are 1024 character positions on the Model I screen. Each position can hold either an alphanumeric character or a graphics character. Alphanumeric characters have a blank space below them while graphics characters may fill a character position. The blank space under an alphanumeric character is part of that character.

If you try to SET a point in a position which is occupied by an alphanumeric character, that alphanumeric character will be replaced by a graphics character. Because each alphanumeric character has a blank space below it which is associated with that character, you can't set a point in the blank space below the alphanumeric character.

Program Notes

I wanted the keys which move the cursor in the graphics mode to repeat. This can be accomplished in two ways: by writing a keyboard scan subroutine either in Basic using PEEK statements or in machine language, or by erasing the keyboard buffer used by Level II and using the INKEY$ function to scan the keyboard. I used the second method.

Level II maintains a buffer which contains a record of the last keys pressed. It occupies positions 16438-16444 in memory. This buffer is referred to after the keyboard has been scanned so the computer can determine which *new* key has been pressed. This provides key-

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Figure 2. Variables Used By Sketch/Print

Type	Name	Primary Use(s)
Integer	X	x-coordinate of cursor (0-127)
	Y	y-coordinate of cursor (0-47)
	QA	Alphanumeric mode flag
	F	Flashing cursor submode flag
	S	Shift key flag, temporary storage
	T	Temporary storage. Used as parameter to set length of time delay and to hold address of cursor in alphanumeric mode
	QE	Loop counter
	QF	Loop counter in delay subroutine
	N	VAL(QA$). A number, 1-9, indicating the direction of movement.
	X1	x-coordinate of stored location used as initial point in line-drawing submode.
	Y1	y-coordinate of stored location used as initial point in line-drawing submode.
	ID(0-8)	Illegal direction flags. Position 4 is always zero.
Single precision	A	Used in line-drawing calculations
	B	Used in line-drawing calculations
Character string	QA	Used for INKEY$ loop. It holds the character obtained from the keyboard.

board rollover without elaborate hardware.

If zeroes are POKEd into the keyboard buffer, the computer does not know which keys were previously pressed and recognized. For a more complete description of how the keyboard is used by Level II see the book by William Barden which I mentioned earlier.

You may wonder why I used POKE instead of PRINT@ to put a character on the screen. I used POKE because even if you put a semicolon at the end of a PRINT@ statement the screen will scroll when you put a character at position 1023 (the lower righthand corner of the screen).

The multiple IF-THEN-ELSE statements in Sketch/Print are used to avoid using many GOTO statements to jump past the long list of tests. Using lines which have multiple IF-THEN-ELSE statements saves memory and makes the program run fast. Also, a program written that way will appeal more to programmers who like structured programs.

When you write multiple IF-THEN-ELSE statements on one program line, remember to put the highest priority IF-THEN tests first, and, if the logic is complex, make a flowchart.

One of the biggest problems I encountered in writing Sketch/Print was finding an efficient way of testing which directions of motion in the graphics mode were illegal. There are eight different illegal cases. Four of them occur when the cursor is in a corner of the screen. The other four occur when the cursor is at one edge of the screen but not in a corner.

At first I thought eight IF-THEN statements would be needed, but later I thought of a clever method that required only three IF-THEN-ELSE statements. An array with nine elements named ID is used to hold flags which indicate which directions are illegal. Each position in the ID array corresponds to a key in the numeric keypad. The fifth position in the array corresponds to the 5 key which does not move the cursor so it is never an illegal direction.

The IF-THEN-ELSE statement in line 210 checks to see if the cursor is at the left or right edge of the screen and if one of those situations exists, sets appropriate flags indicating which horizontal directions are illegal.

The IF-THEN-ELSE statement in line 220 checks to see if the cursor is at the top or bottom of the screen, and, if one of those situations exists, sets appropriate flags indicating illegal vertical directions.

In line 250, the direction of motion you request is compared with the list of illegal directions. If the direction is illegal, the computer goes back (to line 170) and awaits your next command. When the cursor is in a corner one illegal direction flag is set by both the test for illegal horizontal directions and the test for illegal vertical directions. That is a minor inefficiency.

If you plan to modify Sketch/Print or want to learn how it works, look at Figure 2 which lists the variables used in the program.

You might want to modify Sketch/Print so it would do one, several, or all of the following functions on command: reverse graphics; draw a border; scroll the screen left, right, up, or down; or automatically draw a triangle, rectangle, ellipse, circle, or other figure. □

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CIRCLE 311 ON READER SERVICE CARD

Colorful Circles

Alan Foxx

Circle Fill is a program designed to allow the Apple II to fill in circles. See Listing 1. The program first draws a circle, saving each point into two arrays. The x-coordinate of each point is saved in the array AX. The y-coordinate of each point is saved in the array AY.

For example, the x-coordinate of the first point is saved in AX(1). The y-coordinate of the first point is saved in AY(1). The x-coordinate of the second point is saved in AX(2). The y-coordinate of the second point is saved in AY(2) and so on.

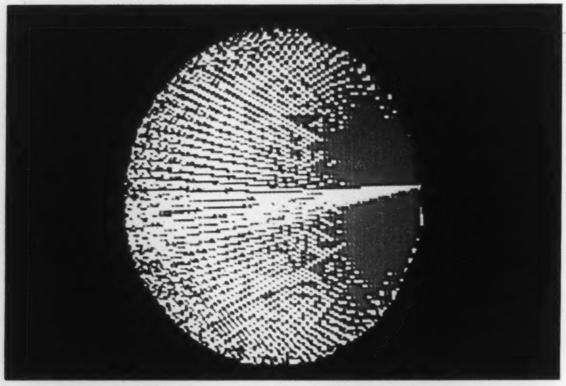
The outer perimeter of the circle is composed of 100 dots (see Figure 1), therefore AX(100) and AY(100) contain the value of the coordinates of the 100th and last dot.

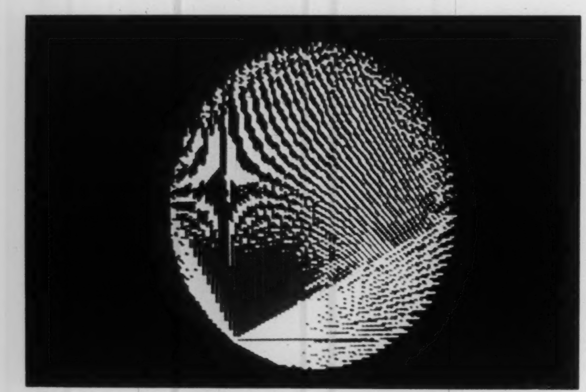
After drawing the circle, the program fills the circle in. It accomplishes this by connecting each dot on the outer perimeter of the circle to all the others. Lines are drawn connecting the first dot to the second dot, the first dot to the third dot, the first dot to the fourth dot and so on. This routine occurs in lines 230 thru 260. To speed up this process you may change line 230 to read:

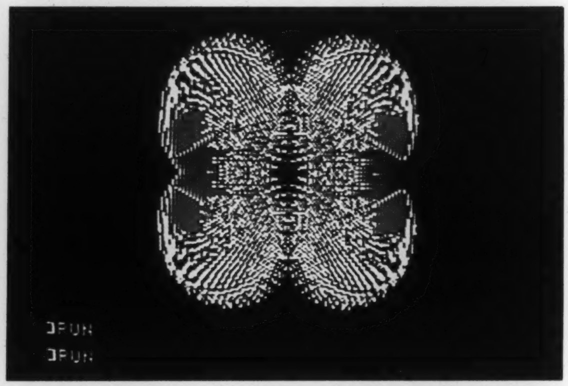
```
230 FOR J = 1 TO 100 STEP 10
```

Alan Foxx, 28090 Tavistock Trail, Southfield, MI 48034.

You may want to make some changes in the program. For example, to change the color of the circle, change line 120. To change the diameter of the circle change the value of







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WAY OUT	DK	34
WIZARD AND PRINCESS	DK	28
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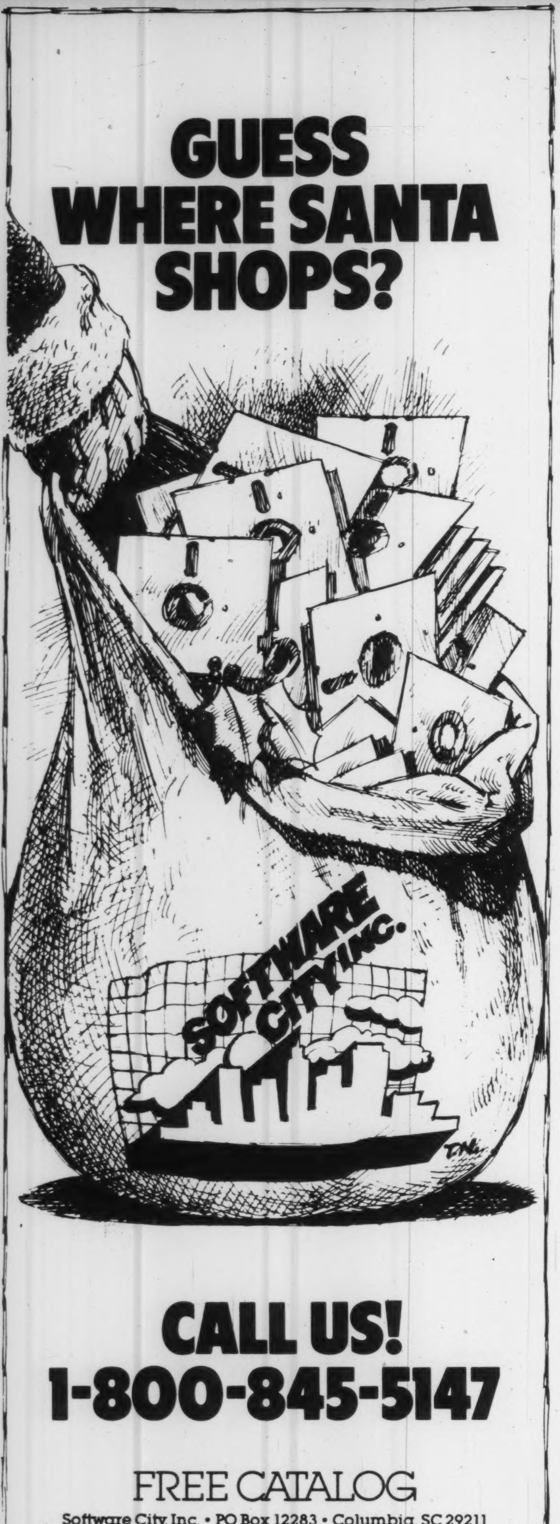
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Colorful Circles, continued...

DIAM in line 130. To move the circle to another position on the screen, change the variables XP and YP in line 130.

One word of caution: the entire circle must be on the screen. Therefore do not make the circle too big or you will get an illegal quantity error in line 200.

To make an ellipse change line 180 to read:

```
180 AX(C) = R * SIN (J) / 3 + XP
```

or change line 190 to read:

```
190 AY(C) = R * COS (J) / 3 + YP
```

Figure 1. Circle before fill-in.

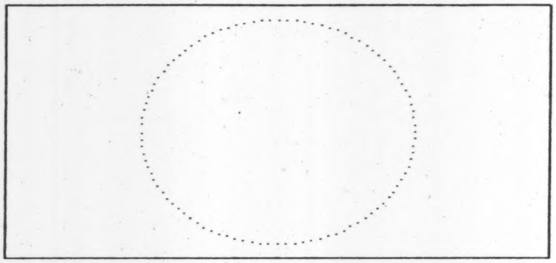
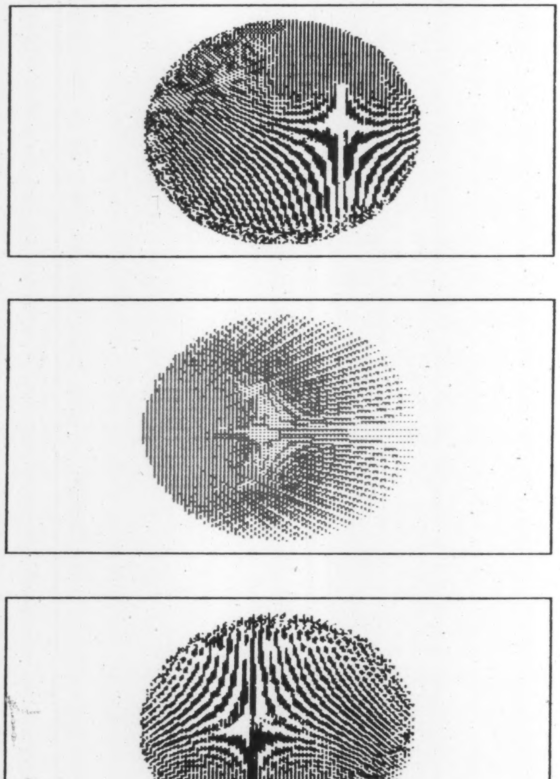


Figure 3.
Examples of what the Colorful Circle program can do.



The Colorful Circle

The Colorful Circle program in Listing 2 produces some very interesting patterns using the circle formula, and the random number generator.

Like Circle Fill, this program draws a circle with 100 dots and saves each dot into two arrays. Then, changing colors each time, lines are drawn connecting each dot to every other dot to produce interesting patterns. Figure 3 shows some examples of what this program can do.

Figure 2. Circle after fill-in.

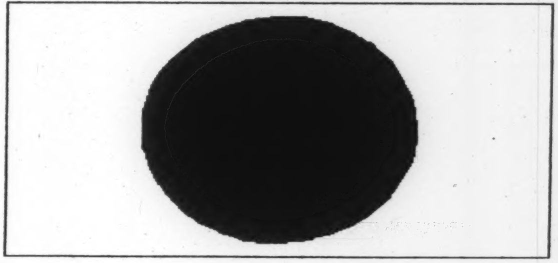
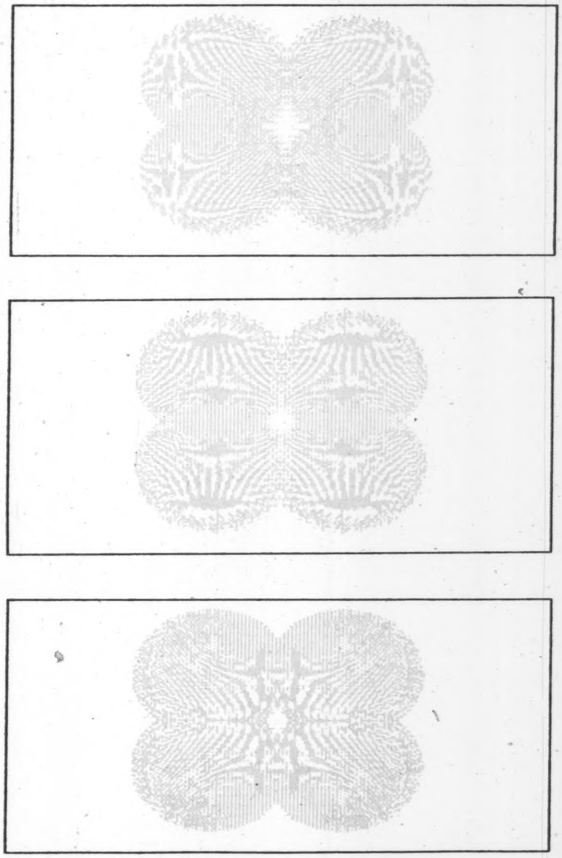


Figure 4.
Examples of what the Four Colorful Circles program can do.



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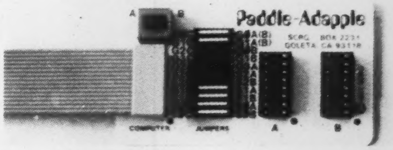

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CIRCLE 269 ON READER SERVICE CARD

Colorful Circles, continued...

Four Colorful Circles

The Four Colorful Circles program in Listing 3 is very similar to the Colorful Circle program. It incorporates the following changes: Instead of one circle there are now four on the screen, and the number of dots is decreased from 100 to 50. Another change was that the colors are only 1 and 2 (green and blue) instead of random.

The program uses a symmetry algorithm. In other words, when the computer plots a dot at (x,y) it will also plot three more dots at (279-x,y), (x,159-y), and (279-x,159-y). Figure 4 shows some examples of what the Four Colorful Circles program can do. ☐

Listing 1.

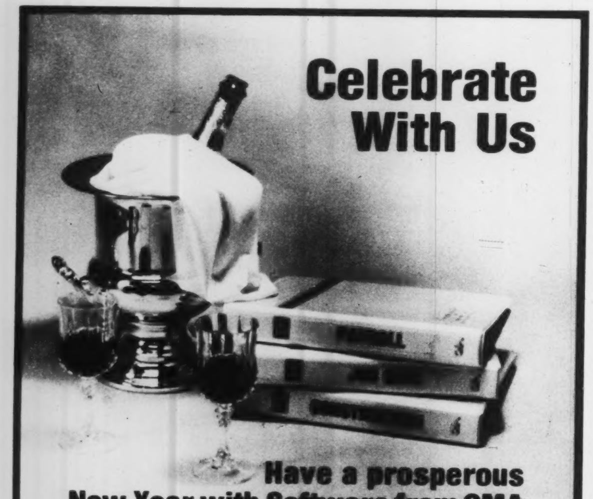
```
100  REM  CIRCLE FILL
110  DIM AX(100),AY(100)
120  HGR : HCOLOR= 3:C = 0
130 DIAM = 140:XP = 70:YP = 80
140 PI = 3.14159:INC = PI / 100
150  FOR J = 0 TO PI STEP INC
160 C = C + 1
170 R = DIAM *  SIN (J) + 0.5
180 AX(C) = R *  SIN (J) + XP
190 AY(C) = R *  COS (J) + YP
200  HPLOT AX(C),AY(C)
210  NEXT J
220  REM  FILL IN CIRCLE
230  FOR J = 1 TO 100 STEP 3
240  FOR C = J TO 100
250  HPLOT AX(C),AY(C) TO AX(J),A
     Y(J)
260  NEXT : NEXT
```

Listing 2.

```
100  REM  COLORFUL CIRCLE
110  DIM AX(100),AY(100)
120  HGR : HCOLOR= 3:C = 0
130 DIAM = 140:XP = 70:YP = 80
140 PI = 3.14159:INC = PI / 100
150  FOR J = 0 TO PI STEP INC
160 C = C + 1
170 R = DIAM *  SIN (J) + 0.5
180 AX(C) = R *  SIN (J) + XP
190 AY(C) = R *  COS (J) + YP
200  HPLOT AX(C),AY(C)
210  NEXT J
220  REM  FILL IN CIRCLE
230  FOR J = 1 TO 100
240  FOR C = 1 TO 100
250  HPLOT AX(C),AY(C) TO AX(J),A
     Y(J)
260  NEXT C
270  HCOLOR=  INT ( RND (1) * 7) +
     1
280  NEXT J
```

Listing 3.

```
100  REM  FOUR COLORFUL CIRCLES
110  DIM AX(51),AY(51)
120  HGR : HCOLOR= 3:C = 0
130 DIAM = 80:XP = 65:YP = 50
140 PI = 3.14159:INC = PI / 50
150  FOR J = 0 TO PI STEP INC
160 C = C + 1
170 R = DIAM *  SIN (J) + 0.5
180 AX(C) = R *  SIN (J) + XP
190 AY(C) = R *  COS (J) + YP
200  HPLOT AX(C),AY(C)
210  NEXT J:W = 0
220  REM  FILL IN CIRCLE
230  FOR J = 1 TO 50
240  FOR C = 1 TO 50
250  HPLOT AX(C),AY(C) TO AX(J),A
     Y(J)
260  HPLOT 279 - AX(C),AY(C) TO 2
     79 - AX(J),AY(J)
270  HPLOT 279 - AX(C),159 - AY(C
     ) TO 279 - AX(J),159 - AY(J)
280  HPLOT AX(C),159 - AY(C) TO A
     X(J),159 - AY(J)
290  NEXT C
300 W = W + 1: IF W > 2 THEN W =
     1
305  HCOLOR= W
310  NEXT J
```



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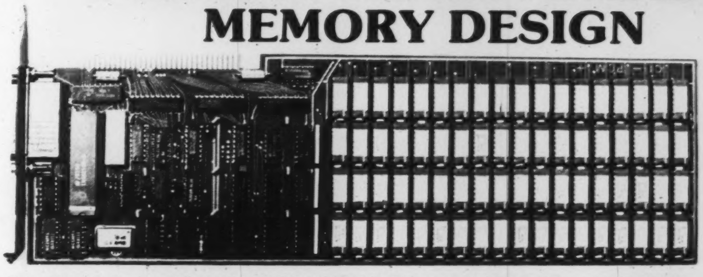

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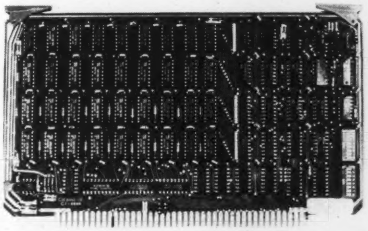

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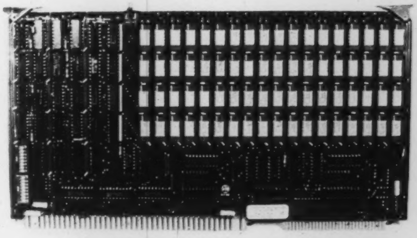

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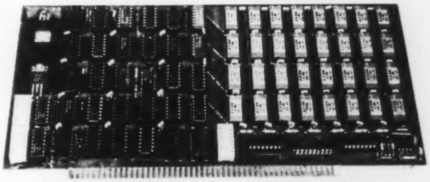
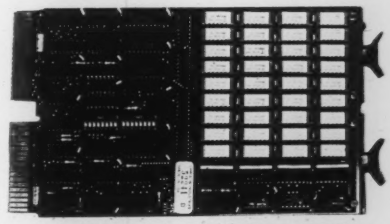


64KB SINGLE BOARD S100 MEMORY

- Addressable as a contiguous block in 4K word increments.
- Battery back-up capability.
- Functions with on-board refresh.

SINGLE QTY. PRICE: $390.00



256KB SINGLE BOARD LSI 11 MEMORY

- On board parity generator checker.
- Addressable as a contiguous block in 4K word increments through 4 megabytes.
- Battery back-up mode.

SINGLE QTY. PRICE: 128K x 18 $795.00
32K x 18 $390.00

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SUPERBRAIN*****
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(See Availability box MBASIC/CBASIC)

CARD GAMES

NEW

BRIDGE MASTER (Available for all computers) Price: $21.95 Diskette
If you liked DYNACOMP'S BRIDGE 2.0, you will absolutely love BRIDGE MASTER. BRIDGE MASTER is a comprehensive bridge program designed to provide hours of challenging competition. Bidding features include the Blackwood convention, Stayman convention, pre-emptive openings, and recognition of demand bids and jump-shift responses. After playing a specific hand, you may replay the same hand, with the option of switching cards with your computer opponents. This feature allows you to compare your bidding and playing skills to BRIDGE MASTER. Bonuses for game contracts and slams are awarded as in duplicate bridge. Doubled contracts are scored based upon a computer assigned vulnerability. A score card is displayed at the conclusion of each hand. The score card displays a summary of total hands played, total points scored, number of contracts made and set, and % bids made. BRIDGE MASTER is clearly the best computer bridge program available.
DYNACOMP'S previous BRIDGE 2.0 customers may upgrade to BRIDGEMASTER for a nominal charge of $5.00 plus postage and handling (see ordering information box). Original cassette/diskette must be returned.

BACCARAT (Atari only) Price: $18.95 Cassette/$22.95 Diskette
This is the European card game which is the favorite of the Monte Carlo jet set. Imagine yourself at the gaming table with 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.

GIN RUMMY (Apple diskette only) Price: $22.95 Diskette
This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are superb. What else can be said?

POKER PARTY (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32K (or larger) Apple II.

GO FISH (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GO FISH is a classic children's card game. The opponent is a friendly computer with user inputs that are simple enough for small children to easily master. The Apple and Atari versions employ high resolution graphics for the display of hands. A must for children! Runs in 16K.

NEW

BLACKJACK COACH (32K TRS-80 only) Price: $29.95 Cassette/$33.95 Diskette
BLACKJACK COACH teaches and evaluates professional playing methods. This program will coach you using the Basic and the Complete Card Counting Methods. The BLACKJACK COACH can be used in automatic, unattended play to test the playing and betting strategies you select. Extensive summary reports pinpoint the strengths and weaknesses of various methods of play. All the standard player choices are included: Insurance, splitting pairs, double downs and surrender (optional). A line printer may be used to collect data. If you risk money at the tables, increase your skills with the BLACKJACK COACH!

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Available for all computers) Price: $25.95 Cassette/$29.95 Diskette
This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

FLIGHT SIMULATOR (Available for all computers) Price: $19.95/Cassette/$23.95 Diskette
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) Price: $17.95 Cassette/$21.95 Diskette
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 x 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique, Personal Computing and Creative Computing.

BACKGAMMON 2.0 (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

NEW

FROG MASTER (Atari only) Price: $17.95 Cassette/$21.95 Diskette
The Atari APEX first prize winner. FROG MASTER contains exciting arcade features in addition to being a highly educational program. It is a fast-moving high-concentration game for 1-4 players. You score by making touchdowns on the opponents' goal line – if his goalie doesn't get there first. But your players (tadpoles and frogs) must be trained. This is accomplished by giving them a reward at just the right moment when they do something right. This takes precise timing and judgement. Your critters must penetrate barriers and avoid evil line backs if they are to score. Many will fall by the wayside, but some will get through. As they learn you can look inside their heads to see how they think. As you reward them, they reward you (the "thought processes" simulated demonstrate the basic type of animal learning - operant conditioning - widely studied in high school and college courses). As you teach them they teach you how learning takes place! Great graphics! Runs in 16K. Requires two joysticks.

FOREST FIRE! (Atari only) Price: $14.95 Cassette/$18.95 Diskette
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalities. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

CRANSTON MANOR ADVENTURE (North Star, SuperBrain and CP/M only) Price: $19.95 Diskette
At last! A comprehensive Adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette.

SPACE EVACUATION! (Available for all computers) Price: $15.95 Cassette/$19.95 Diskette
Can you colonize the galaxy and evacuate the Earth before the sun explodes? Your computer becomes the ship's computer as you explore the universe to relocate millions of people. This simulation is particularly interesting as it combines many of the exciting elements of classic space games with the mystery challenge of ADVENTURE.

MONARCH (Atari only) Price: $14.95 Cassette/$18.95 Diskette
MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs in 16K Atari.

NEW

RUBIK'S CUBE SOLVER (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette/$21.45 Disk
Solving the Rubik's cube puzzle is an exercise in algorithimic logic, and is a "natural" for computer calculation. The RUBIK'S CUBE SOLVER permits you to input the starting state of the 24 facing elements of the cube. It then solves the problem one step at a time, with each step shown as a unfolded view of the cube. Can you solve the cube in fewer steps. In any case, it sure beats disassembling the cube or peeling off and replacing the colors! Requires 16K.

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II), NEC and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density/double density compatible format) 8" CP/M floppy disks for systems running under MBASIC or CBASIC (for example, Altos, Xerox 820, Heath/Zenith and many others). 5¼" CP/M diskettes are available for the North Star, SuperBrain and Osborne computer systems.

**ATARI, PET/CBM, NORTH STAR, CP/M, IBM, OSBORNE, SUPERBRAIN, NEC PC-8000 and XEROX are registered tradenames and/or trademarks.*

***Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER. TRS-80 diskettes are not supplied with either DOS or BASIC.*

****For most North Star disk-based systems.*

*****For Altair systems having Microsoft BASIC.*

******For SUBERBRAIN systems running under MBASIC or CBASIC (state which).*

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AND MORE...

STARBASE 3.2 (Available for all computers) Price: $13.95 Cassette/$17.95 Diskette
This is the classic space simulation, but with several new features. For example, the Croylins now shoot at the Invincible without warning while also attacking starbases in other quadrants. The Croylins also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Invincible is besieged by three heavy cruisers and a starbase S.O.S. is received! The Croylins get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

LIL' MEN FROM MARS (Atari only) Price: $19.95 Cassette/$23.95 Diskette
Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a hilarious high resolution animated graphics (arcade) game which exercises much of the Atari's power. Requires one joystick.

NEW

ALVIN (Atari only) Price: $17.95 Cassette/$21.95 Diskette
ALVIN is a great arcade game. You are commanding a highly maneuverable ship seeking to destroy several enemy cities. You are attempting to bomb these cities while at the same time trying to avoid their defensive fire (MISSILE COMMAND™ in reverse?). Also, your radar has been damaged so that you can only see downwards. This would normally not be much of a problem except that you also have to contend with high-flying enemy aircraft. As long as you are above these aircraft you have the advantage and are safe. However, high level bombing takes considerable skill. Therefore to achieve your goal the best strategy is to swoop down for a bombing run while the enemy craft is out of range, and quickly retreat to the skies. A fun game. Requires 16K.

ESCAPE FROM VOLANTIUM (Atari only) Price: $15.95 Cassette/$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTIUM! To escape you must maneuver your space ship around obstacles and laser blast the guardian (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new guardian appears. Sometimes you can smash through the door by repeatedly chipping away at it. Other times it is impervious. At the higher levels of play more obstacles and guardians appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 16K.

ALPHA FIGHTER (Atari only) Price: $13.95 Cassette/$17.95 Diskette
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) Price: $14.95 Cassette/$18.95 Diskette
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) Price: $15.95 Cassette/$19.95 Diskette
This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

MIDWAY (Atari 32K only) Price: $14.95 Cassette/$18.95 Diskette
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs in 16K.

NEW

GOLF PRO (Atari only) Price: $17.95 Cassette/$21.95 Diskette
Both realism and beautiful graphics are joined together in GOLF PRO to produce the best golf simulation available. To really appreciate this game, you should have a color TV so that you can see the green of the fairway, the blue of the water hazards, and the white sand of the traps. You tee off with a wood, use your wedge in the sand trap, and putt on the green just as would be done on the course. Show off the Atari to your friends with GOLF PRO. Requires 16K and one joystick.

GAMES PACK I (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.
Why pay $9.95 or more per program when you can buy a DYNACOMP collection for just $14.95?

MOON PROBE (Available for all computers) Price: $12.95 Cassette/$16.95 Diskette
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.

SPACE TRAP (Atari only, 16K) Price: $14.95 Cassette/$18.95 Diskette
This galactic "shoot 'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

SUPER SUB CHASE (Atari only) Price: $19.95 Cassette/$23.95 Diskette
SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them sink towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.

TWO PLAYER GAMES

NEW

TWO PLAYER GAMES (Available for all computers; 32K disk/diskette only)
DYNACOMP has acquired the distribution rights to the best eight of Xitron's war games. These two-player games were originally written for the North Star computer, but have since been converted to play on all of the computers currently supported by DYNACOMP. Because our licensing and development costs were so low, DYNACOMP offers these programs two to a disk(ette) for only $19.95/diskette, $23.95/disk. If you like war games, then this is a bargain you can not pass up.

Set #1: **PANZER and BLITZKRIEG**
PANZER
Date: 23 Nov. 1943 Place: Several miles west of Kiev, Russia. The Russians have just liberated Kiev and are moving quickly to reach the German forces which are preparing for a last desperate attempt to halt the Russian advance.
BLITZKRIEG
Date: Spring 1940 Place: Northern France. The German blitzkrieg in the east was complete. Germany had turned its attention to the west: France. The German forces has penetrated the Ardennes and Meuse. The heroism of Dunkirk, the defense of the Aisne-Somme position, and the final collapse of the French armies in the south has all passed. And, now, the drive on Paris . . .

Set #2: **STARSHIP TROOPERS and INVASION OF THE MUD PEOPLE**
STARSHIP TROOPERS
Date: Fortieth Century Place: Arachnid planet of Sheol. The first all-out battle on the planet Sheol which will match equal forces of Terran and alien units. The outcome will set the course of the conflict, for the planet of Sheol is a key position in the solar war.
INVASION OF THE MUD PEOPLE
A Peruvian army battalion has been dispatched to a remote village area to investigate the destruction of many local dwellings and the disappearance of most of the villagers. Eye-witnesses have reported strange creatures appearing from scores of slimy mud holes which have oddly begun forming across the terrain.

Set #3: **FALL OF THE THIRD REICH and ARMORCAR**
FALL OF THE THIRD REICH
Date: March, 1945 Place: Remagen, Germany. The allies under General Eisenhower had reached the Rhine. The Germans had failed in destroying the Ludendorff railroad bridge, allowing several allied divisions to cross before it finally collapsed on March 17 ... and so, the allies began their drive on Berlin.
ARMORCAR
Date: 2 Feb. 1944 Place: Minsk, Russia. A German front-line unit is hard pressed for radio equipment and medical supplies. A relief convoy of armored cars must reach them through partisan-infested territory.

Set #4: **MOUNT SURIBACHI and MIDDLE EARTH**
MOUNT SURIBACHI
Date: 16 Feb. 1945 Place: Iwo Jima. The Japanese opened fire from Mount Suribachi as the marines landed on the porkchop-shaped island. Gunfire from the hill could cover the entire island, thus it was a critical objective if the Americans were to capture and utilize the all-important air field. Mount Suribachi proved to be one of the most strongly defended positions in the Japanese theatre of war.
MIDDLE EARTH
Date: 1997 Place: MIDDLE EARTH. Through a maze of tunnels, crevices, and rocky passageways discovered leading from an inactive volcano in South America, a team of United Nations' researchers have undertaken a mission to an uncharted frontier: the center of the Earth. After a perilous journey spanning a period of several months, the mission has arrived at the Earth's core, a land of flames, steam, oceans, and unforeseen vegetation. And then the creatures of MIDDLE EARTH appeared . . . unmatched by the most frightening horror stories created by man . . .

MISCELLANEOUS

CRYSTALS (Atari only) Price: $14.95 Cassette/$18.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.
Price: $9.95 each/$8.95 each (4 or more)
The complete collection may be purchased for $159.95.

NEW

5¼" DISKETTES (soft sectored/ten sectored) Price: $39.95/20 Diskettes
As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!

BUSINESS and UTILITIES

NEW

PORTFOLIO MANAGEMENT (Apple only) — **Price: $69.95 two Diskettes**

The PORTFOLIO MANAGEMENT package was written by a stock broker to help manage portfolios for individual customers. With this program data files can be easily created and kept up to date. A variety of reports can be generated for clients which are attractively and professionally laid out. The user may define his/her own investment catagories. PORTFOLIO MANAGEMENT is a top quality, professional tool which will not only provide you with new conveniences but will also serve to enhance your appearance as an efficient and up to date advisor to your clients. Comes complete on two diskettes along with a 30 page instruction manual.

NEW

PERSONAL FINANCE SYSTEM (Available for all computers) — **Price: $39.95 Diskette**

PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations. Contains high speed machine language sort. PFS has been demonstrated on network (CBS) TV!

FAMILY BUDGET (Apple and Atari only) — **Price: $34.95 Diskette**

FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

NEW

TEXT MASTER (Apple 32K, diskette only) — **Price: $49.95 Diskette**

TEXT MASTER is a general purpose text editor for the Apple II computer. It features powerful, English-oriented commands which permit the complete manipulation of textural information. The information treated may be correspondence, computer programs, data to be used by other programs, and more. TEXT MASTER also interfaces with any printer connected to your Apple. The minimum system requirements are 32K of RAM, Applesoft on ROM, at least one disk, and a lower case adapter. TEXT MASTER can process any length file segment by segment. Thus it is possible to process files as large as a diskette. Comes complete with an efficient 16 page manual. TEXT MASTER is equivalent in capability to many word processing systems costing 3 x or more in price. The commands available in TEXT MASTER are: COLLECT, USE, EXECUTE, NONUM, INSERT, MERGE, STOP, RENUM, DELETE, SAVE, COPY, FREE, REPLACE, WAIT, MOVE, LENGTH, LIST, RESAVE, CLEAR, AUTO, RETRY, APPEND, SET, MANUAL, CHANGE, SCRATCH, SHOW, CATALOG, MODIFY, COMPARE, NUM, DISPLAY, HELP.

INTELINK (Atari only) — **Price: $49.95 Diskette**

This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a *very* smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

NEW

PAYFIVE (Apple II plus diskette, two drives required) — **Price: $149.95**

This is an enormously flexible employee payroll system with extraordinarily good human engineering features. PAYFIVE prints checks and compiles the required federal, state and local forms for up to 148 employees. The pay methods may be hourly, salary, commission or any combination. There are multiple options for pay periods, and they also can be used in any combination. PAYFIVE includes *many* other features and comes extremely well documented with a 200 page manual. The manual may be purchased separately for $30, and that payment later applied to the software purchase.

SHOPPING LIST (Atari only) — **Price: $12.95 Cassette/$16.95 Diskette**

SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

NEW

TAX OPTIMIZER (Available for all computers) — **Price: $59.95 Diskette**

The TAX OPTIMIZER is an easy-to-use, menu-oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

STOCK MASTER/STOCK PLOT (Apple 48K) — **Price: $59.95 Diskette**

This is a full-featured stock portfolio management and analysis system. Ten years of records on up to thirty stocks may be maintained. You may record prices, revenue, earnings/share, ROE, quarterly earnings and dividends, transactions, long/short term gains, P/E, indexes (DJ, S & P, NASDAQ) and MORE! You may plot (HIRES) the price history of any stock against any other, time, or the indexes. Portfolio value may be evaluated at any time. Comes complete with superbly written instructions and sample files on a second diskette.

TURNKEY AND MENU (Atari only) — **Price: $17.95 Diskette**

TURNKEY is a utility program which allows you to create autoboot/autorun diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

STOCKAID (Atari only) — **Price: $29.95 Diskette**

STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with oscillators. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days x 16 stocks. Included are stock dividend and split adjustment capabilities. A very professional package!

NEW

NYINDEX (Atari only) — **Price: $29.95 Diskette**

NYINDEX is a comprehensive software package for storing, retrieving and plotting New York Stock Exchange information. The daily data treated includes the composite index, advances, declines, new highs and new lows. Graphical displays include the above plus the index oscillator, cumulative advances/declines and moving averages. Data entry and editing is easy. The diskette includes more than two years of daily data. NYINDEX is an excellent companion to STOCKAID.

PLAYER-MISSILE GRAPHICS TABLET (Atari only) — **Price: $19.95 Diskette**

The PLAYER-MISSILE GRAPHICS TABLET was designed to take the drudgery out of developing four color displays in GRAPHICS MODE 7. No longer will you have to read the locations of those tiny blocks on your graph paper and calculate PLOTs and DRAWTOs. With PMG you will be able to easily design colorful graphic displays with your joystick and save them on diskette for later recall.

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STATISTICS and ENGINEERING

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This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**

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This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

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HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

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REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

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BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

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Price per collection: $16.95 Cassette/$20.95 Diskette
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Collection #1: Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
Collection #2: Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.)
Collection #3: Chapter 3 - Functional approximations by iteration and recursion.
Collection #4: Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5: Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
Collection #6: Chapter 6 - Methods for finding the real roots of functions.
Collection #7: Chapter 7 - Methods for finding the complex roots of functions.
Collection #8: Chapter 8 - Optimization by steepest descent.
Price per collection: $14.95 Cassette/$18.95 Diskette

All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).

Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP:

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NEW

BEAM DEFLECTION (Available for all computers) (disk/diskette only) — **Price: $29.95 Diskette/$32.45 Disk**

BEAM DEFLECTION is the first in DYNACOMP's new series of structural analysis software packages. It consists of two programs. The first program permits the development of data files which describe the problem. For example, the ends of the beam may be pinned, clamped or free. The beam may be uniformly supported by an elastic bed, or held up by springs variously placed and having differing spring constants. The elasticity and cross section of the beam may vary along its length. The load may be uniformly distributed or it may include discrete forces. The beam may be pinned at various points along its length. And so on. All this information may be easily entered and edited using the data input program.

Following this the analysis program is called. The calculated results are the stress and deflections of the beam, both in numerical and graphical form. since the input data is saved, cases may be easily re-run with modification, thereby permitting iterative design.

The documentation which comes with BEAM DEFLECTION clearly shows how to use the software. In addition, three text problems are described and demonstrated to ensure that you understand how to use the program. Also, helpful theoretical information is supplied in the appendix.

STATTEST (Not available on Atari cassette or for PET/CBM) — **Price: $19.95 Cassette/$23.95 Diskette**

This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the differences in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. This menu-directed statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

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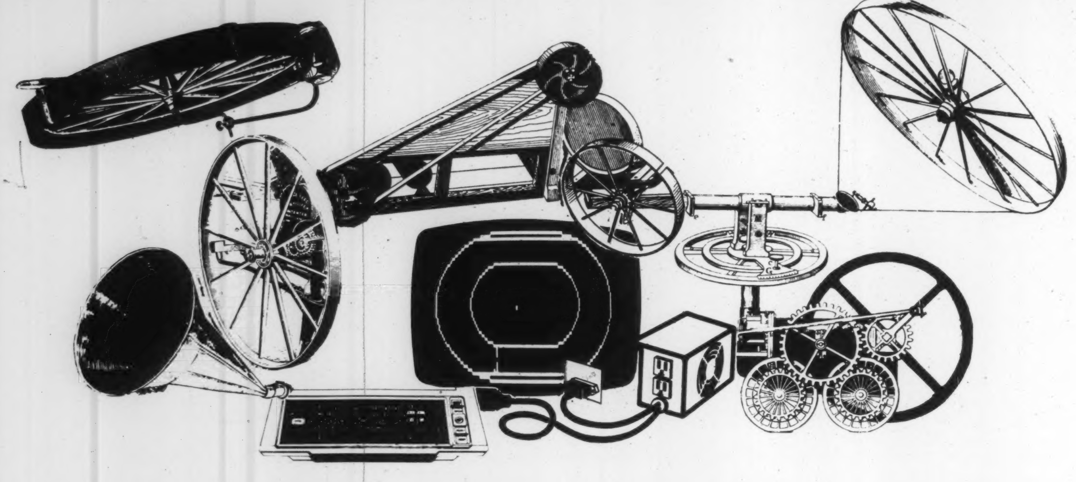

Programming Wheels

Robert D. Hastings

Anyone who writes computer programs will get the feeling sooner or later that he is reinventing the wheel when developing code to perform common functions.

The purpose of this article is to help you avoid the need to reinvent some common programming wheels. The wheels provided here are subroutines developed as part of an overall Medical Office system that I have written.

They include a method of printing standardized error messages, an input checking routine, a number checker, a date checker, and a way to manipulate time (now doesn't that sound intriguing).

The individual subroutines may be used singly or nested together in a program.

The system used to develop these routines is an IBM Personal Computer with 64K memory, one 5 1/4" floppy disk drive, a color graphics display board, a parallel printer interface with a C. Itoh Model 1540 printer, and an El Cheapo 13" black and white TV set. The system runs with IBM DOS and Advanced Disk BASIC. Wherever I have used an unusual IBM Basic statement, an explanation of its function is included.

Error Messages

Let's start with the subroutine that is the most important part of any program that is operated by the uninitiated (that is anyone who doesn't eat, drink, and sleep with a computer as you and I do). This is the routine which prints a customized error message on the bottom of the display in response to incorrect operator input or a program failure condition. *Big deal*, you might say. So did I until I tried to create the routine and made 483 stupid mistakes. I did verify Programmer's Hypothesis #27 which states that programming errors increase exponentially with the lateness of the hour.

Listing 1 is the error printing subroutine. The information that must be prepared prior to calling the subroutine is the actual error message stored in ERR MSG$ (clever variable name, huh?) and the position of the cursor prior to entering the subroutine stored in ROW and COL. In IBM Basic, this is acquired as follows:

```
100 ROW = CSRLIN : COL = POS(0)
```

The subroutine performs several functions. It sets an error flag to indicate that an error has been printed, beeps to wake you up, prints the error message in reverse video on the bottom of the screen, and, if called in response to an incorrect input by the operator, erases the incorrect input and returns the cursor to the original location.

IBM Basic has several interesting features which are used here. The normal video size is 24 x 40 or 24 x 80. This is software controlled by the WIDTH X command. The 25th line is normally used to display the mnemonics associated with the ten function keys located on the left side of the keyboard. However, the 25th line may be used by a program if the mnemonics are turned off. Line 970 does this.

If this line were located at the beginning of the main program, it would not have to be repeated here. A unique feature of this magic 25th line is both a blessing and a curse. This is the fact that the 25th line does *not* scroll upward with the rest of the screen when information is displayed —what a perfect place to anchor an error message.

Now for the secret curse. Even though the 25th line does not scroll, if the contents to be printed on the line exceed the display width, the remainder of the line is printed on the 24th line and does scroll upward. Stay tuned for an explanation of how this was cleverly deduced. But first, back to the listing.

Line 990 is not a gag. The BEEP statement toggles an 800 MHz. tone through the PC speaker for a quarter of a second. PRINT CHR$(7) serves the same function. The LOCATE command in line 1000 moves the cursor to row 25, column 1 and turns off the cursor. Line 1010 invokes reverse video (black on white) and line 1020 prints the error message.

Now back to the curse. The STRING-$(X,Y) function returns a string of length X whose characters all have ASCII code Y. POS(0) returns the present cursor column position which, in this application, would appear right at the end of the error message.

What I wanted to do was to print white blanks to the end of the line so that the entire line would be in reverse video, regardless of the length of the message. That's what I wanted to do. However,

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Robert D. Hastings, 1122 South Brook Street, Louisville, KY 40203.

on the 24th line which then merrily moves upward on the screen as you print other information.

If the previous dissertation made no sense at all, just remember to keep error messages shorter than the display width. To insure that this would not happen to me again, I defined the variable WIDE= 40 in the main program to be the value of the display width.

Then I changed line 1020 to truncate the error message to the length set by WIDE. The LEFT$(X$,Y) function does this by creating a substring of X$ that starts at the leftmost character and extends for a length of Y characters.

The next two lines, 1030 and 1040, return the video to normal and the cursor to the position it occupied prior to printing the error message. But before we leave this fancy routine, let's do one more thing.

Good programming practice demands that the program print a prompt prior to each operator input and then check the input for correctness. If an error is detected, the program should print an error message and prompt the operator for another input.
since the Medical System would use an 80-character monitor, I thought I would save myself a few keystrokes later on by extending the STRING$ function to the end of an 80-character line with STRING $(80,32).

What I had missed was a piece of information on page 4-186 of the IBM Basic manual which states that "If the printed line is longer than the defined WIDTH, Basic goes to the next physical line and continues printing." My El Cheapo TV displays a 40-character line.

As I mentioned before, when you try to print an 80-character string on the non-scrolling 25th line of a 40-character display, the remainder of the line is printed

Remember that ROW and COL contain the location of the cursor prior to the printing of the error. Line 1050 prints a string of blanks to erase the incorrect input and line 1060 returns the cursor to its original position.

All of this may seem to be a great deal of trouble just to print an error message, but there are important programming principles at work here. All error messages should be easy to read, easy to understand, and should attract the operator's attention immediately. This routine accomplishes two of the three objectives. Clear and simple error message text will accomplish the third.

Checking Input

A second subroutine (Listing 2) developed in the total Medical Office system provides a method of checking an operator input to see if it is a number. The operator input is placed in the variable, CHECK$. The subroutine first sets the error flag, MISTAKE, to zero and prints a line of blanks on the 25th line.

The variable BLANK$ has been defined in the main program as a 40-character string of blanks. Remember that the 25th line is where error messages are printed by the error printing routine.

The number checking subroutine then looks at each character individually with the MID$(X$,Y,Z) function. X$ is the string to be divided, Y is the starting position, and Z is the number of characters in the substring.

Line 880 checks to see if the ASCII value of the substring lies between 48 and 57—the digits 0 through 9. If the entire input is numeric, the subroutine returns to the main program. If a non-numeric character is found, line 890 checks to see if it is a decimal point. If is not a decimal point, then ERRMSG$ is loaded with the proper error message and the error printing subroutine is called.

Since the error printing routine changes the value of MISTAKE from zero to one, it is an easy matter for the main program to detect an error by checking the value of MISTAKE.

Editing Input

Many business programs make use of multiple menus to guide operator input. They also allow the operator to return to the main menu or to the beginning of the program by pressing the ESC key. The next subroutine (Listing 3) provides this capability, as well as some input editing features.

```
                           SUBROUTINE
                                .
                                .
                                .
             120 IF ASC(I$)=27 THEN FLAG=1 : RETURN
                                .
                                .
                          MAIN PROGRAM
                                .
                                .
                                .
             1675 FLAG=0
             1680 GOSUB 70  'INPUT ROUTINE
             1685 IF FLAG=1 THEN 1640  'GO TO MAIN MENU
```

Figure 1.

After initializing the INPT$ variable, the routine turns on a medium sized cursor with the LOCATE,,1,6,7 command. The 1 means turn on, and the 6,7 specifies the cursor size and position.

Lines 100 and 110 wait for an operator keystroke. Each keystroke undergoes four tests. ASCII value 27 in line 120 is the value for the ESC key, which returns the subroutine to line number 1640 at the beginning of the main program. Most Basic languages do not include this feature. This line could be changed to set a flag which the main program could check. See Figure 1 for an example.

The second check is for ASCII value 13 which is the RETURN key, the normal exit from the subroutine. The IBM keyboard has two keys that can be used to erase characters from a line, the BACKSPACE key and the DEL key. ASCII value 8, the BACKSPACE key, is checked in line 140. The DEL key returns a two-character string when pressed. The ASCII value of the second character is 83. Line 150 checks for this key. If either keystroke is detected, a short routine is called.

This routine shortens INPT$ by one character, backs up the cursor, prints a space, and then backs up the cursor again. This has the effect of erasing one character from the screen. If the four checks are passed, then the character is added to INPT$ and printed. Line 170 is needed because the INKEY$ function does not automatically display the keystroke on the screen.

Checking The Date

Often a program requires a knowledge of the present date. IBM Basic has a DATE$ function. However, if the operator makes an incorrect input while setting the date, Basic prints an error message and crashes.

I needed the ability to check operator input, to generate the appropriate error message (Where have I seen that before?), and to allow the operator to correct the mistake. I also needed the month, day, and year in separate variables. The subroutine in Listing 4 provides these features. It uses the other subroutines that we have already developed.

The format for the date that is checked by this subroutine is MM/DD/YYYY or MM-DD-YYYY. The date to be checked is contained in DTE$. The INSTR function in line 1130 searches for the location of the first occurrence of a slash character. The same function could be accomplished with the following loop:

```
1135 IF MID$(DTE$,Y,1)="/" THEN
     1200
1140 NEXT Y
```

If no slash is found, the INSTR function returns a zero, and the first occurrence of a hyphen is checked. If no hyphen is found, the error printing routine is called.

If a slash is found, line 1200 extracts the substring containing the month. This substring is sent to the number checking routine and then is checked to see if it is a valid month.

Lines 1290 and 1310 look for the second occurrence of a slash or a hyphen. The substring containing the day is extracted and is run through the same checks. Finally, the same procedure is used to isolate and check the year.

If all checking is successful, the date is broken into the variables MO, DAY, and YEAR before the subroutine returns to the main program.

Manipulating Time

Now let's manipulate time. In several programs that I have written, the operator has been required to wait while a long sort or file transfer takes place. The time delay has been dependent upon the number of records being handled. The time to process a single record can be estimated.

The total transaction time can be calculated based on the number of records times the single record processing time. Then it is a simple matter to provide the operator with an indication of the time required to complete the entire process. Listing 5 does this.

The only information needed by the subroutine is S, the total number of seconds for the entire transaction. The subroutine calculates the hours and minutes.

It converts these separate values into strings for concatenation (that means stick them together into one thing) into HH:MM:SS format.

Unfortunately, IBM Basic places a space in front of each number when converting it to a string. The routine in Lines 730-800 strips away the space and adds a zero to any value that is only one digit long.

Finally, Line 710 puts the whole mess together. That's concatenation! This can be printed in an appropriate message telling the operator to go get a cup of coffee.

Since IBM Basic has an internal clock accessible through the TIME$ function, I carried the subroutine one step farther and calculated the time at which the process would be finished.

This is done by separating TIME$ into hours, minutes, and seconds; adding the transaction time to these values; and reconverting the total to HH:MM:SS format. Lines 330-520 adjust the date if the total transaction time exceeds 24 hours. The subroutine uses the Date Check subroutine (Listing 4) to separate today's date, which is stored by the internal IBM clock in DATE$, into DAY, MO, and YEAR variables.

To show how these subroutines can interact with one another, I have written a simple program that asks for the date and time, prints out the separated date and then calculates a file transfer time. See Listing 6. Remember that error messages appear in reverse video at the bottom of the screen.

I hope that you can apply these routines and their underlying principles to the programs that you develop for your computer. Perhaps they will save you the trouble of reinventing a wheel or two while keeping your programming efforts rolling merrily along. □

Listing 1.

```
 960 '***** PRINT ERROR MESSAGE *****
 970 KEY OFF
 980 MISTAKE=1
 990 BEEP : BEEP
1000 LOCATE 25,1,0
1010 COLOR 0,7 ' REVERSE VIDEO
1020 PRINT LEFT$(ERRMSG$,WIDE);STRING$(WIDE-POS(0),32);
1030 COLOR 7,0 'NORMAL IMAGE
1040 LOCATE ROW,COL
1050 PRINT STRING$(WIDE-COL+1,32)
1060 LOCATE ROW,COL
1070 RETURN
1080 '***** END OF ERROR MESSAGE  *****
```

Listing 2.

```
820 '***** NUMBER CHECK *****
830 MISTAKE=0
840 LOCATE 25,1,0
850 PRINT BLANK$;
860 FOR Z=1 TO LEN(CHECK$)
870 N$=MID$(CHECK$,Z,1)
880 IF ASC(N$)=>48 AND ASC(N$)<=57 THEN 900
890 IF N$<>"." THEN 920
900 NEXT Z
910 RETURN
920 ERRMSG$="Sorry! Digits only, please."
930 GOSUB 960 ' PRINT ERROR MESSAGE
940 RETURN
950 '***** END NUMBER CHECK
```

Listing 3.

```
 70 '***** INPUT ROUTINE *****
 80 INPT$=""
 90 LOCATE,,1,6,7
100 I$=INKEY$
110 IF I$="" THEN 100
120 IF ASC(I$)=27 THEN RETURN 1640 ' ESC
130 IF ASC(I$)=13 THEN PRINT :RETURN ' <CR>
140 IF ASC(I$)=8 THEN GOSUB 190 : GOTO 100 'BCKSP KEY
150 IF LEN(I$)=2 THEN IF ASC(RIGHT$(I$,1))=83 THEN
    GOSUB 190 : GOTO 100 ' DEL KEY
160 INPT$=INPT$+I$
170 PRINT I$;
180 GOTO 100
190 INPT$=LEFT$(INPT$,LEN(INPT$)-1)
200 LOCATE CSRLIN,POS(0)-1
210 PRINT " ";
220 LOCATE CSRLIN,POS(0)-1
230 RETURN
240 '***** END INPUT *****
```

Listing 4.

```
1090 '***** DATE CHECK *****
1100 LOCATE 25,1,0 :PRINT BLANK$;
1110 MISTAKE=0
1120 Y1$=DTE$
1130 Y= INSTR(DTE$,"/")
1140 IF Y<>0 THEN 1200
1150 Y=INSTR(DTE$,"-")
1160 IF Y<>0 THEN 1200
1170 ERRMSG$="Please use MM/DD/YYYY format."
1180 GOSUB 960 ' PRINT ERROR MESSAGE
1190 RETURN
1200 CHECK$=MID$(DTE$,1,Y-1)
1210 GOSUB 820 ' NUMBER CHECK
1220 IF MISTAKE=1 THEN RETURN
1230 MO=VAL(CHECK$)
1240 IF MO>0 AND MO<13 THEN 1280
1250 ERRMSG$="The month must be between 1 and 12."
1260 GOSUB 960 ' PRINT ERROR MESSAGE
1270 RETURN
1280 Y1=Y+1
1290 Y= INSTR(Y1,DTE$,"/")
1300 IF Y<>0 THEN 1360
1310 Y=INSTR(Y1,DTE$,"-")
1320 IF Y<>0 THEN 1360
1330 ERRMSG$="Please use MM/DD/YYYY formCLS
1340 GOSUB 960 ' print error message
1350 RETURN
1360 CHECK$=MID$(DTE$,Y1,Y-Y1)
1370 GOSUB 820 ' NUMBER CHECK
1380 IF MISTAKE=1 THEN RETURN
1390 DAY=VAL(CHECK$)
1400 IF DAY>0 AND DAY<32 THEN 1440
1410 ERRMSG$="I only know days between 1 and 31."
1420 GOSUB 960 ' print error message
1430 RETURN
1440 CHECK$=MID$(DTE$,Y+1,LEN(DTE$))
1450 GOSUB 820 ' NUMBER CHECK
1460 IF MISTAKE=1 THEN RETURN
1470 IF LEN(CHECK$)=4 THEN 1510
1480 ERRMSG$="The year must be 4 digits long."
1490 GOSUB 960 ' PRINT ERROR MESSAGE
1500 RETURN
1510 YEAR=VAL(CHECK$)
1520 LOCATE ROW+1,1
1530 RETURN
1540 '***** END OF DATE ROUTINE *****
```

Listing 5.

```
250 '***** TIME CALCULATION *****
260 GOSUB 600
270 PRINT :PRINT "The transfer will take ";T$;"
    (H:M:S)"
280 PRINT :PRINT "The present time is ";TIME$
290 S=S+VAL(RIGHT$(TIME$,2))
300 S=S+60*(VAL(MID$(TIME$,4,2))+M)
310 S=S+3600*(VAL(LEFT$(TIME$,2))+H)
320 GOSUB 600
330 DTE$=DATE$
340 ROW=CSRLIN : COL=POS(0)
350 GOSUB 1090 ' DATE CHECK
360 DT$=""
370 IF H<=24 THEN 410
380 H=H-24 :GOSUB 650
390 DAY=DAY+1
400 GOTO 370
410 IF DAY <=31 THEN 440
420 DAY=DAY-31
430 MO=MO+1
440 IF MO<=12 THEN 470
450 MO=MO-12
460 YEAR=YEAR+1
470 T1$=STR$(DAY) : GOSUB 740
480 DAY$=T2$
490 T1$=STR$(MO) : GOSUB 740
500 MO$=T2$
510 T1$=STR$(YEAR) : GOSUB 740 : YR$=T2$
520 DT$=MO$+"/"+DAY$+"/"+YR$
530 PRINT :PRINT "The transfer will end at ";T$;"
    ";DT$
540 PRINT :PRINT "Do you wish to start the transfer
    (YES or NO) ";
550 GOSUB 70 ' INPUT
560 IF LEFT$(INPT$,1)<>"y" AND LEFT$(INPT$,1)<>"Y"
    THEN STOP
570 PRINT :PRINT "All done!!!"
580 RETURN
590 '***** CONVERT SEC TO H:M:S *****
600 T$=""
610 M=INT(S/60)
620 H=INT(S/3600)
630 M=M-H*60
640 S=S-(H*3600+M*60)
650 T1$=STR$(H) : GOSUB 740
660 H$=T2$
670 T1$=STR$(M): GOSUB 740
680 M$=T2$
690 T1$=STR$(S): GOSUB 740
700 S$=T2$
710 T$=H$+":"+M$+":"+S$
720 RETURN
730 '***** STRIP SPACES & ADD 0 *****
740 T2$=""'ELIMINATE SPACES
750 FOR Z=1 TO LEN(T1$)
760 IF MID$(T1$,Z,Z)=" " THEN 780
770 T2$=T2$+MID$(T1$,Z,1)
780 NEXT Z
790 IF LEN(T2$)<2 THEN T2$="0"+T2$
800 RETURN
810 '***** END OF TIME ROUTINE *****
```

Listing 6.

```
 10 SCREEN 0,0,0
 20 WIDE=40 ' VARIABLE CONTAINING DISPLAY WIDTH
 30 BLANK$ = SPACE$(WIDE-1) 'SPACES
 40 KEY OFF
 50 WIDTH (WIDE) 'SETS DISPLAY WIDTH
 60 GOTO 1550
 70 '***** INPUT ROUTINE *****
 80 INPT$=""
 90 LOCATE,,1,6,7
100 I$=INKEY$
110 IF I$="" THEN 100
120 IF ASC(I$)=27 THEN RETURN 1640 ' ESC
130 IF ASC(I$)=13 THEN PRINT :RETURN ' <CR>
140 IF ASC(I$)=8 THEN GOSUB 190 : GOTO 100 'BCKSP KEY
150 IF LEN(I$)=2 THEN IF ASC(RIGHT$(I$,1))=83 THEN
    GOSUB 190 : GOTO 100 ' DEL KEY
160 INPT$=INPT$+I$
170 PRINT I$;
180 GOTO 100
190 INPT$=LEFT$(INPT$,LEN(INPT$)-1)
```

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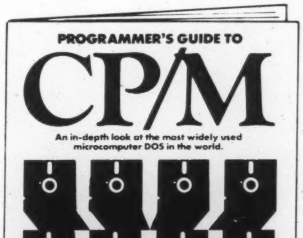
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```
200 LOCATE CSRLIN,POS(0)-1
210 PRINT " ";
220 LOCATE CSRLIN,POS(0)-1
230 RETURN
240 '***** END INPUT *****
250 '***** TIME CALCULATION *****
260 GOSUB 600
270 PRINT :PRINT "The transfer will take
    ";T$;" (H:M:S)"
280 PRINT :PRINT "The present time is ";TIME$
290 S=S+VAL(RIGHT$(TIME$,2))
300 S=S+60*(VAL(MID$(TIME$,4,2))+M)
310 S=S+3600*(VAL(LEFT$(TIME$,2))+H)
320 GOSUB 600
330 DTE$=DATE$
340 ROW=CSRLIN : COL=POS(0)
350 GOSUB 1090 ' DATE CHECK
360 DT$=""
370 IF H<=24 THEN 410
380 H=H-24 :GOSUB 650
390 DAY=DAY+1
400 GOTO 370
410 IF DAY <=31 THEN 440
420 DAY=DAY-31
430 MO=MO+1
440 IF MO<=12 THEN 470
450 MO=MO-12
460 YEAR=YEAR+1
470 T1$=STR$(DAY) : GOSUB 740
480 DAY$=T2$
490 T1$=STR$(MO) : GOSUB 740
500 MO$=T2$
510 T1$=STR$(YEAR) : GOSUB 740 : YR$=T2$
520 DT$=MO$+"/"+DAY$+"/"+YR$
530 PRINT :PRINT "The transfer will end at
    ";T$;" ";DT$
540 PRINT :PRINT "Do you wish to start the
    transfer (YES or NO) ";
550 GOSUB 70 ' INPUT
560 IF LEFT$(INPT$,1)<>"y" AND LEFT$(INPT$,1)<>"Y"
    THEN STOP
570 PRINT :PRINT "All done!!!"
580 RETURN
590 '***** CONVERT SEC TO H:M:S *****
600 T$=""
610 M=INT(S/60)
620 H=INT(S/3600)
630 M=M-H*60
640 S=S-(H*3600+M*60)
650 T1$=STR$(H) : GOSUB 740
660 H$=T2$
670 T1$=STR$(M): GOSUB 740
680 M$=T2$
690 T1$=STR$(S): GOSUB 740
700 S$=T2$
710 T$=H$+":"+M$+":"+S$
720 RETURN
730 '***** STRIP SPACES & ADD 0 *****
740 T2$=""'ELIMINATE SPACES
750 FOR Z=1 TO LEN(T1$)
760 IF MID$(T1$,Z,Z)=" " THEN 780
770 T2$=T2$+MID$(T1$,Z,1)
780 NEXT Z
790 IF LEN(T2$)<2 THEN T2$="0"+T2$
800 RETURN
810 '***** END OF TIME ROUTINE *****
820 '***** NUMBER CHECK *****
830 MISTAKE=0
840 LOCATE 25,1,0
850 PRINT BLANK$;
860 FOR Z=1 TO LEN(CHECK$)
870 N$=MID$(CHECK$,Z,1)
880 IF ASC(N$)=>48 AND ASC(N$)<=57 THEN 900
890 IF N$<>"." THEN 920
900 NEXT Z
910 RETURN
920 ERRMSG$="Sorry! Digits only, please."
930 GOSUB 960 ' PRINT ERROR MESSAGE
940 RETURN
950 '***** END NUMBER CHECK
960 '***** PRINT ERROR MESSAGE *****
970 KEY OFF
980 MISTAKE=1
990 BEEP : BEEP
1000 LOCATE 25,1,0
1010 COLOR 0,7 ' REVERSE VIDEO
1020 PRINT LEFT$(ERRMSG$,WIDE);STRING$
    (WIDE-POS(0),32);
1030 COLOR 7,0 'NORMAL IMAGE
1040 LOCATE ROW,COL
1050 PRINT STRING$(WIDE-COL+1,32)
1060 LOCATE ROW,COL
1070 RETURN
1080 '***** END OF ERROR MESSAGE  *****
1090 '***** DATE CHECK *****
1100 LOCATE 25,1,0 :PRINT BLANK$;
1110 MISTAKE=0
1120 Y1$=DTE$
1130 Y= INSTR(DTE$,"/")
1140 IF Y<>0 THEN 1200
1150 Y=INSTR(DTE$,"-")
1160 IF Y<>0 THEN 1200
1170 ERRMSG$="Please use MM/DD/YYYY format."
1180 GOSUB 960 ' PRINT ERROR MESSAGE
1190 RETURN
1200 CHECK$=MID$(DTE$,1,Y-1)
1210 GOSUB 820 ' NUMBER CHECK
1220 IF MISTAKE=1 THEN RETURN
1230 MO=VAL(CHECK$)
1240 IF MO>0 AND MO<13 THEN 1280
1250 ERRMSG$="The month must be between 1 and 12."
1260 GOSUB 960 ' PRINT ERROR MESSAGE
1270 RETURN
1280 Y1=Y+1
1290 Y= INSTR(Y1,DTE$,"/")
1300 IF Y<>0 THEN 1360
1310 Y=INSTR(Y1,DTE$,"-")
1320 IF Y<>0 THEN 1360
1330 ERRMSG$="Please use MM/DD/YYYY formCLS
1340 GOSUB 960 ' print error message
1350 RETURN
1360 CHECK$=MID$(DTE$,Y1,Y-Y1)
1370 GOSUB 820 ' NUMBER CHECK
1380 IF MISTAKE=1 THEN RETURN
1390 DAY=VAL(CHECK$)
1400 IF DAY>0 AND DAY<32 THEN 1440
1410 ERRMSG$="I only know days between 1 and 31."
1420 GOSUB 960 ' print error message
1430 RETURN
1440 CHECK$=MID$(DTE$,Y+1,LEN(DTE$))
1450 GOSUB 820 ' NUMBER CHECK
1460 IF MISTAKE=1 THEN RETURN
1470 IF LEN(CHECK$)=4 THEN 1510
1480 ERRMSG$="The year must be 4 digits long."
1490 GOSUB 960 ' PRINT ERROR MESSAGE
1500 RETURN
1510 YEAR=VAL(CHECK$)
1520 LOCATE ROW+1,1
1530 RETURN
1540 '***** END OF DATE ROUTINE *****
1550 '***** START OF MAIN PROGRAM *****
1560 CLS :PRINT :PRINT
1570 PRINT "        HELLO, THERE!"
1580 GOTO 1610
1590 INPUT "What time is it (HH:MM)";TM$
1600 TIME$=TM$
1610 PRINT : PRINT "Is this the correct time
    (YES or NO) ";TIME$;" ";
1620 INPUT INPT$
1630 IF LEFT$(INPT$,1)<>"Y" AND LEFT$(INPT$,1)<>"y"
    THEN 1590
1640 PRINT :PRINT
1650 PRINT "What is today'date"
1660 PRINT "Use MM/DD/YYYY format => ";
1670 ROW=CSRLIN :COL=POS(0)
1680 GOSUB 70 ' INPUT
1690 DTE$=INPT$
1700 GOSUB 1090 ' DATE CHECK
1710 IF MISTAKE=1 THEN 1680
1720 INPUT "What is your name";NME$
1730 PRINT :PRINT
1740 PRINT "The date is ";DTE$

1750 PRINT "The year is ";YEAR
1760 PRINT "The month is ";MO
1770 PRINT "The day is ";DAY
1780 INPUT "Give me the number of seconds to
    complete the file transfer ";S
1790 GOSUB 250
1800 PRINT "Isn't that wonderful, ";NME$
1810 END
```

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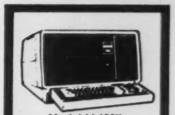

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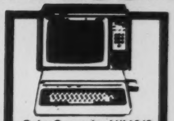

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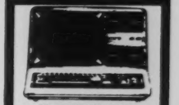

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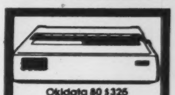

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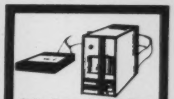

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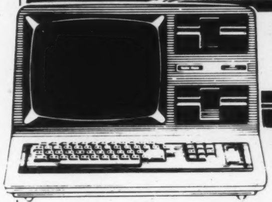

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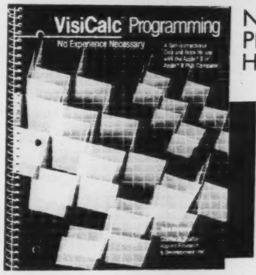

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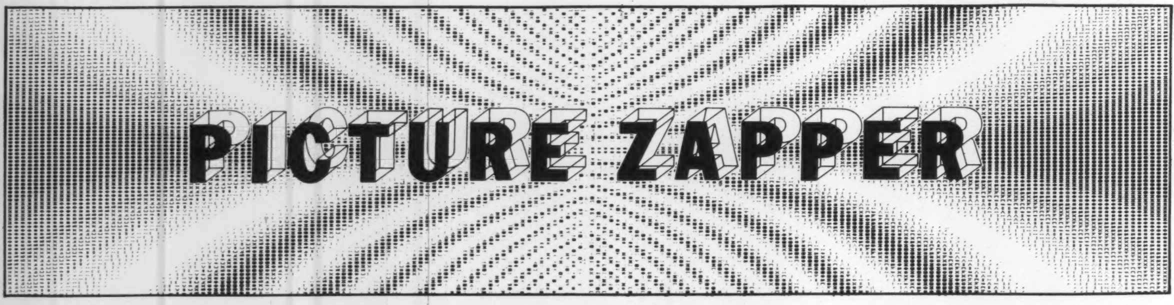

William Tenney

While developing a game program in Applesoft recently, I came up against a rather thorny problem which left me stumped. My particular game requires a fairly complex hi-res game board across which pieces are moved by the players.

My thorny problem arises when moving a game piece from one position to another on the game board; the piece must be erased or xdrawn before it can be drawn in the next position. However, in doing this, part of the background of the game board itself is also erased, leaving a gaping black hole. Since my game is not of the interstellar or galactic warfare type, black holes are definitely not wanted.

There are a few options for overcoming this little problem with my 48K Apple II Plus. One, and perhaps the most obvious to the reader, is to plan always to have a black background for the game board, and to plan the size, shape, and positions of the game pieces so that they never overlap any other image elements.

This is fine, but since my game board is rather complicated with many small pieces on it, and since I am quite tired of seeing other game boards on black backgrounds, this option is less than satisfactory.

A second option is to redraw the game board after each move and then redraw the game pieces in their new positions. But with a complex board with many color blocks, lines, and figures, it takes a full minute to draw the board and all its parts—not practical at all to wait a full minute after each move before going on with the game.

A third option is to store the entire game board image on the disk using a BSAVE command, and then to call it back to the hi-res screen using a BLOAD command. This works fine, but although the time of loading and drawing the game board is reduced from one minute to about thirteen seconds, the disk drive is in motion for each move of the game—far too much wear and tear on the disk and drive, and still too much time wasted waiting for the disk to turn on and draw the image on the screen with its venetian blind imitation.

So these three options proved to be unworkable for me from both hardware and aesthetic points of view. But, I thought to myself, why couldn't I attempt what the memory expansion boards are touting with their disk simulators? Couldn't I move the 8K hi-res image to another part of memory, store it there, and call it back to the same hi-res screen whenever I needed it, and faster than using a BLOAD?

To accomplish this from Basic was the problem, because all it would be was a simple memory move in the monitor. With this in mind, I wrote a short machine language program which very successfully does just what I wanted.

The Program

The program uses an Applesoft routine called COMBYTE which resides in $E74C (thanks to Roger Wagner for pointing it out). COMBYTE checks for a comma, reads the expression which follows, and returns with a single byte ($00 to $FF) in the X-register, which can then be stored in a zero-page location. The four zero-page locations used are shown in Figure 1.

The program cycles 32 times ($20 in line $0315), each pass reading and moving a 256-byte page of memory. It runs incredibly fast, moving all 32 pages, or an entire 8K image, in about .3 seconds.

Since I am using hi-res screen 2 ($4000 - $5FFF) for my game image, but need the region of the hi-res screen 1 for my program and variables, I decided that a good place to store my image would be right above hi-res screen 2, at $6000. This location is well below the HIMEM of

Figure 1.

Low byte of the source location = $06 (SOURCE-LO)
High byte of the source location = $07 (SOURCE-HI)
Low byte of the destination location = $08 (DESTIN-LO)
High byte of the destination location = $09 (DESTIN-HI)

William Tenney, 77 Wood St., Concord, MA 01742.

$95FF (with DOS in effect), and since the image is $2000 bytes long, it does not bump into any string variables stored from HIMEM on down.

To use this routine from Applesoft—to move an image from hi-res screen 2 to the storage area at $6000—my syntax is as follows:

```
CALL 768,0,64,0,96
```

where 768 is equal to $300, the starting point of the routine, 0 is the SOURCE-LO, 64 is the SOURCE-HI (remember that 64 = $40), 0 is the DESTIN-LO, and 96 is the DESTIN-HI (96 = $60).

To move the image back to the hi-res screen 2 (while keeping it at the storage location as well), the syntax is

```
CALL 768,0,96,0,64
```

To really speed up your programming, you could set up a "&" hook:

```
POKE 1014,0: POKE 1015,3
```

which sets a Jump instruction to $300 Then your syntax would be

```
&,0,64,0,96 and &,0,96,0,64
```

Now I can erase a game piece by redrawing the entire game board using this routine, and then draw the game pieces in their respective places, all in less than a second. The game proceeds at a good clip.

Of course, this short program can be used to move any block of memory anywhere, since it is merely a memory move routine. You need only work in blocks of 256 bytes and know the starting point and number of memory pages (store this number in $0315).

A low-res image, for example, is only four pages long. The machine language coding is completely relocatable to any spare 40 bytes of memory (remember that at a different location your CALL would be to the start of your routine). Try it, you'll like it. For moving pictures around, the program is superb—and no more black holes or venetian blinds. ☐

Listing 1. Picture Zapper.

```
0300-   20 4C E7     JSR  $E74C
0303-   86 06        STX  $06
0305-   20 4C E7     JSR  $E74C
0308-   86 07        STX  $07
030A-   20 4C E7     JSR  $E74C
030D-   86 08        STX  $08
030F-   20 4C E7     JSR  $E74C
0312-   86 09        STX  $09
0314-   A2 20        LDX  #$20
0316-   A9 00        LDA  #$00
0318-   A8           TAY
0319-   B1 06        LDA  ($06),Y
031B-   91 08        STA  ($08),Y
031D-   C8           INY
031E-   D0 F9        BNE  $0319
0320-   E6 07        INC  $07
0322-   E6 09        INC  $09
0324-   CA           DEX
0325-   D0 F2        BNE  $0319
0327-   60           RTS
```

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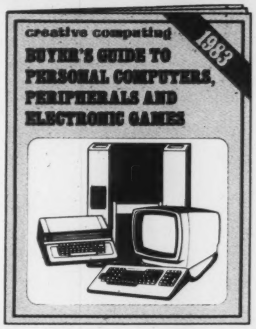
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Drawart

Brad Pitzel

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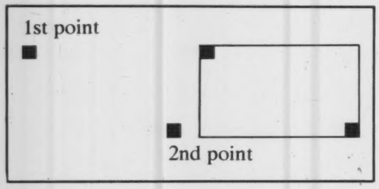
Figure 1.



The commands are as follows:

Cursor Control: Pressing one of the arrow keys will move the cursor in the direction indicated on the key. You can't press more than one key at a time.

Draw/Erase Mode: The cursor in Drawart can be set in either the draw or erase mode. Pressing the spacebar reverses the current mode.

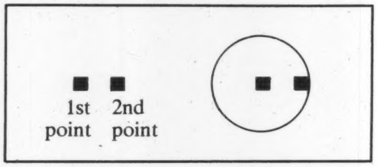
Lines: To enter the line mode, press L. Once you are in this mode, you must plot two points by using the spacebar and the arrow keys. Press G and these dots will be connected by a straight line in the order in which they were plotted.

Rectangles: Pressing R places you in the rectangle mode. By using the cursor control keys and the spacebar, plot two dots. After you plot the second dot, the computer will fill in the area between the two dots.

Circles: Press C to enter the circle mode. Plot two dots that have the same Y axis. The first point is the center of your circle and the second designates the radius.

Block Move: To store the ASCII values of the entire screen into the memory addresses 26000 to 27023, press P. You can then continue drawing. ☐

Figure 2.



Brad Pitzel, 122 Meadowbrook Dr., Nova Scotia, Canada.

Listing 1.

```
10 CLS : CLEAR : DIM X(255), Y(255), Q(40), W(40)
20 Q=64 : W=24 : SET (Q,W) : X(32)=-1 : X(64)=1
25 Y(8)=-1 : Y(16)=1 : R=1
30 GOSUB 1000 : IF FK=1 THEN R=-R
40 A$=INKEY$ : IFA$="" THEN 30
50 IF A$="L" THEN 2000
60 IF A$=CHR$(31) THEN CLS
70 IF A$="R" THEN 4000
80 IF A$="C" THEN 5000
90 IF A$="P" THEN 6000
100 GOTO 30
1000 FK=0 : A=PEEK(14400) : IF A=0 THEN RETURN
1010 IF R=-1 THEN RESET (Q,W)
1020 Q1=Q : W1=W : Q=Q+X(A) : W=W+Y(A)
1025 IF Q<0 Q=Q+128 ELSE IF Q>127 Q=Q-128
1026 IF W<0 W=W+48 ELSE IF W>47 W=W-48
1030 FK=0 : IF A=128 FOR ZA=1 TO 30 : NEXT : FK=1
1040 SET(Q,W) : RETURN
2000 R=-1 : T=0
2010 GOSUB 1000 : IF INKEY$="G" THEN 2040
2015 IF R=1 AND (Q(T)<>Q OR W(T)<>W) THEN R=-R
2020 IF FK=0 THEN 2010
2030 R=1 : IF Q=Q(T) AND W=W(T) THEN 2010
2035 T=T+1 : Q(T)=Q : W(T)=W : IF T<40 THEN 2010
2040 IF T<2 THEN 30
2050 FOR GT=1 TO T-1 : X=Q(GT) : Y=W(GT)
2055 X1=Q(GT+1) : Y1=W(GT+1)
2060 GOSUB 3000 : NEXT : GOTO 30
3000 IF ABS(X1-X) < ABS(Y1-Y) THEN 3070
3010 FOR X2=X TO X1 STEP 2*(X1<X)+1
3020 SET(X2,(X2-X)*(Y1-Y)/(X1-X)+Y+.5)
3030 NEXT : RETURN
3070 FOR Y2=Y TO Y1 STEP 2*(Y1<Y)+1
3080 SET(.5+(Y2-Y)*(X1-X)/(Y1-Y)+X,Y2)
3090 NEXT : RETURN
4000 R=-1 : T=0
4010 GOSUB 1000
4015 IF R=1 AND (Q(T)<>Q OR W(T)<>W) R=-1
4020 IF FK=0 THEN 4010
4030 R=1 : IF Q=Q(T) AND W=W(T) THEN 4010
4035 T=T+1 : Q(T)=Q : W(T)=W : IF T=1 THEN 4010
4040 FOR I=Q(1) TO Q(2) STEP SGN(Q(2)-Q(1))
4050 FOR J=W(1) TO W(2) STEP SGN(W(2)-W(1))
4060 SET(I,J) : NEXT J,I : GOTO 30
5000 R=-1 : T=0
5010 GOSUB 1000
5015 IF R=1 AND (Q(T)<>Q OR W(T)<>W) R=-1
5020 IF FK=0 THEN 5010
5030 R=1 : IF Q=Q(T) AND W=W(T) THEN 5010
5035 T=T+1 : Q(T)=Q : W(T)=W : IF T=1 THEN 5010
5040 X=ABS(Q(1)-Q(2)) : Y=X*3/7
5045 KX=Q(1) : KY=W(2)
5050 T=Y*7/3 : IF X>T THEN T=X
5060 FOR HJ=0 TO 2*3.1415 STEP 1/T
5070 Z1=COS(HJ)*X+KX : Z2=SIN(HJ)*Y+KY
5075 IFZ1<0 OR Z1>127 OR Z2<0 OR Z2>47 THEN 5090
5080 SET(Z1,Z2)
5090 NEXT : GOTO 30
6000 FOR I=15360 TO 16383
6005 POKE I+10640, PEEK(I) : NEXT
6010 CLS : FOR I=15360 TO 16383
6015 POKE I, PEEK(I+10640) : NEXT
6020 GOTO 30
```

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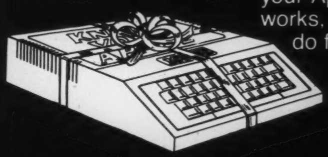

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Eight by Eight Create

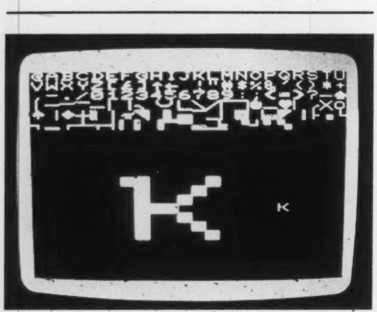
Robert Spahitz

8x8 Create is a program designed for a 5K or 8K Commodore Vic-20 computer. The program allows you to examine the make-up of the Pet character set. While a character is being examined, it can be changed into any other character that can be created in an 8 x 8 matrix, hence the title and program name.

The program works as follows: after loading the program and typing RUN, a countdown appears at the top of the screen. While the countdown is progressing, the remainder of the screen becomes a canvas of changing colors and characters. This delay allows the computer to duplicate the character set into RAM so that it can later be changed. Soon, the screen changes to an orange background with a cyan border. The screen clears and the characters you will be working with are put onto the top few lines of the screen.

When a flashing cursor appears in the upper lefthand corner of the screen, you move the cursor (using the normal cursor control keys) to the character you would like to change. When you arrive at the character, press the left arrow key, and an enlarged copy of the character will be displayed. To the left of this appear eight numbers that tell the computer how the character is created. To the right of both of these is a copy of the character in its normal size.

Once again, a flashing cursor will appear, this time in the upper left of the enlarged character. You move the cursor to the square that you want to turn on or off and hit the RVS/ON (9 key) to light it up (yellow) or the RVS/OFF (0 key) to darken it in (red). As you do this, the character on the far right will change accordingly. Note: if a square is orange, it was off when you began; if it is red it was manually turned off; if it is white, it was on when you began; and if it is yellow, it was manually turned on.



To exit the character-change mode, type either x or +. Hitting the plus key (+) will save the character that you created and return you to character-select mode. To examine the character again, or to get the numbers that can create it, hit the left arrow key. To return the character to the way it was when you first ran the program, just type X instead of +. This also returns you the character-select mode.

Once you have created, designed and examined enough characters, you can copy their associated numbers on paper to be used in any programs you make. Some good designs to try include Space Invader characters, animals, and abstract patterns.

The Program

Lines 10 to 170 initialize everything. The memory pointer (locations 55-56) is adjusted so characters being created are not disturbed by program overhead (string storage).

Lines 20 to 70 duplicate the charac-

Listing 1.

```
5 REM8X8 CREATE:BY R SPAHITZ
10 POKE 56,24:POKE52,24:POKE 37879,150:REMSAVE MEMORY;SPEED UP PROGRAM
20 FOR Z=0 TO 1023
30 PRINT CHR$(19)"COUNTDOWN:"INT((1024-Z)/10.24)
40 POKE RND(1)*484+7702,RND(1)*256
50 POKE RND(1)*484+38422,RND(1)*16
60 POKE Z+6144,PEEK(Z+32768)
70 NEXT Z:REMCHARACTERS COPIED
80 POKE 36879,139
90 POKE 36869,254:REMUSE NEW CHARACTERS
100 PRINT CHR$(147)CHR$(17)CHR$(17)CHR$(17)CHR$(17)CHR$(17);
105 PRINT CHR$(17)CHR$(17)CHR$(17)CHR$(17)CHR$(17)
110 FOR Z=0 TO 7
120 POKE 7664+Z,0
130 POKE 7672+Z,255
140 NEXT Z
150 FOR Z=0 TO 127
160 POKE Z+7680,Z
163 POKE Z+7808,190
```

Robert Spahitz, 143 Dewey Ave., Staten Island, NY 10308.

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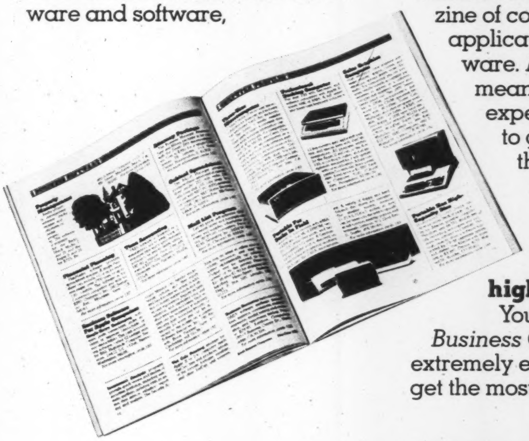

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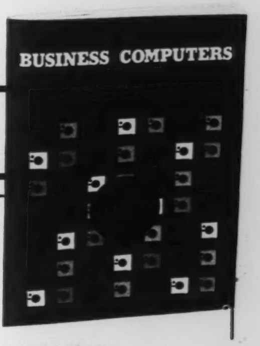

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8 x 8 Create, continued...

ters from ROM to RAM (line 60) while the colorful display of characters is being POKEd into the screen. Memory location 36879 changes the background/border color while 36869 changes from the normal character set to the programmable character set. After the characters are screen-POKEd (line 120), two special characters are created for later use (lines 140-170).

Lines 180 to 290 allow the cursor to move only within the boundary of the printed characters. If a left-arrow is hit (line 280) a jump is made to the section which handles character-changing.

Lines 300 to 360 test the cursor for out-of-bounds and also adjust the variables that will move the cursor (up, down, right, or left).

Lines 370 to 480 print the numbers, enlarged character, and normal-sized character as described in the instructions.

Lines 490 to 560 prepare the present cursor position for any change that may take place.

Lines 570 to 660 allow for the different types of changes (cursor up, down, right, left; exit and restore original character; turn on square; turn off square; or exit and save).

Lines 670 to 710 allow the cursor to move without going beyond the boundaries.

Lines 720 to 750 restore the original character from ROM to the appropriate position, and return program control to the character-select section.

Lines 760 to 800 turn a position on not only in the enlarged character, but also in the normal-sized character.

Lines 810 to 840 turn a position off in both the enlarged character and the normal-sized character.

Notes

When in character-create mode, hit the left arrow then the + to recreate the character in only two colors (orange/white) or to examine the correct numbers required to create the character.

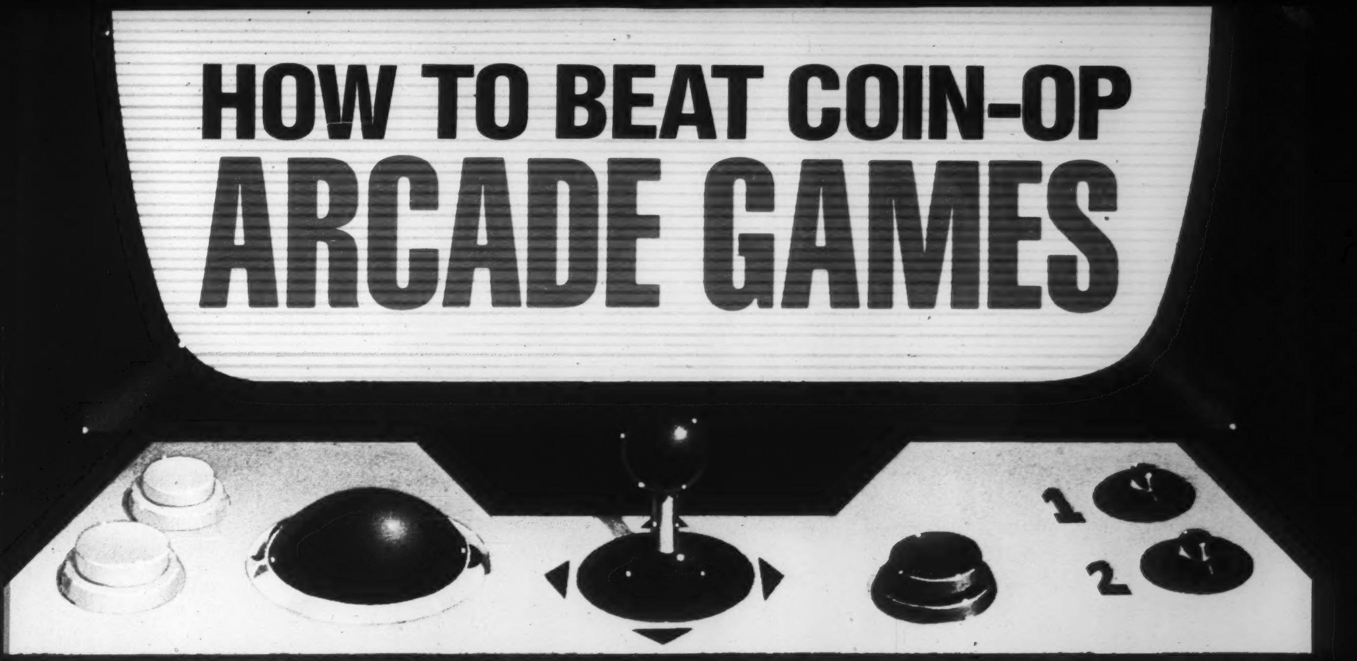
Avoid changing the number characters (0,1,2,3,4,5,6,7,8,9) unless you have no use for the values left of the enlarged character. If you change them, the numbers printed to the left will also be changed. They can be restored using the X function for each number.

To start out with a different character set, change the 32768 in line 60, and the 28672 in line 730 (4096 less than the number in line 60). I suggest using 33792 for reversed upper case, 34816 for lower case, or 35840 for reversed lower case. Caution: using a different character set may affect the appearance of numbers and thereby make reading the numbers virtually impossible. ☐

```
166 POKE Z+7936,190
169 POKE Z+8064,190
170 NEXT Z:REMCHARACTERS NOW ON SCREEN
180 P=7680+22*H+V
190 R=PEEK(P)
200 IF Q=191 THEN Q=R:GOTO 220
210 Q=191:REMCURSOR ON OR OFF
220 POKE P,Q
230 GET A$
240 IF A$=CHR$(29) THEN V=V+1:GOTO 300
250 IF A$=CHR$(157)THEN V=V-1:GOTO 300
260 IF A$=CHR$(17) THEN H=H+1:GOTO 320
270 IF A$=CHR$(145)THEN H=H-1:GOTO 320
280 IF A$=CHR$(95) THEN 370
290 GOTO 200
300 IF V<0 THEN V=-21*(H>0): H=H-1
310 IF V>21 THEN V=0: H=H+1
320 IF H<0 THEN H=0
330 IF H>5 THEN H=5
340 IF H=5 AND V>17 THEN V=17
350 POKE P,R
360 GOTO 180
370 POKEP,R:REM CREATE 8X8 WORKBOX
380 POKE 8005,R
390 FOR Y=0 TO 7
400 S=PEEK(P*8-55296+Y)
410 PRINT S CHR$(157)CHR$(32)CHR$(32)
420 FOR Z=7 TO 0 STEP -1
430 POKE 38655+Y*22-Z,1
440 POKE 7935+Y*22-Z,190
450 IF S>=2↑Z THEN POKE 7935+Y*22-Z,191: S=S-2↑Z
460 NEXT Z
470 NEXT Y
480 PRINT CHR$(145)CHR$(145)CHR$(145)CHR$(145)CHR$(145)CHR$(145)CHR$(145)CHR$(14
5);
490 A=0
500 B=0
510 C=7928+22*B+A
520 D=0
530 IF PEEK(C)=190 THEN D=1
540 POKE C,190
550 POKE C,191
560 IF D=1 THEN POKE C,190
570 GET A$
580 IF A$=CHR$(29) THEN A=A+1:GOTO 670
590 IF A$=CHR$(157)THEN A=A-1:GOTO 670
600 IF A$=CHR$(17) THEN B=B+1:GOTO 690
610 IF A$=CHR$(145)THEN B=B-1:GOTO 690
620 IF A$="X" THEN 720
630 IF A$="9" OR A$=")" THEN 760
640 IF A$="0" THEN 810
650 IF A$="+" THEN 200
660 GOTO 540
670 IF A<0 THEN A=-7*(B>0): B=B-1
680 IF A>7 THEN A=-7*(B=7): B=B+1
690 IF B<0 THEN B=0
700 IF B>7 THEN B=7
710 GOTO 510
720 FOR Y=0 TO 7
730 POKE P*8-55296+Y,PEEK(P*8-28672+Y)
740 NEXT Y:REM ORIGINAL CHARACTER RESTORED
750 GOTO 200
760 POKE C,191:REM SPOT ON
770 POKE C+30720,7
780 D=0
790 POKE 6144+H*176+V*8+B,PEEK(6144+H*176+V*8+B) OR 2↑(7-A)
800 GOTO 540
810 POKE C,190:REM SPOT OFF
820 POKE C+30720,2
830 POKE 6144+H*176+V*8+B,PEEK(6144+H*176+V*8+B) AND 255-2↑(7-A)
840 GOTO 540
```

Table 1.

CHR$ (x)	can be replaced by	found on line(s)
x=19	home key	30
x=147	clear key	100
x=17	cursor down	100, 105, 260, 600
x=29	cursor right	240, 580
x=157	cursor left	250, 410, 590
x=145	cursor up	270, 480, 610
x=95	up arrow (↑)	280
x=32	space ( )	410



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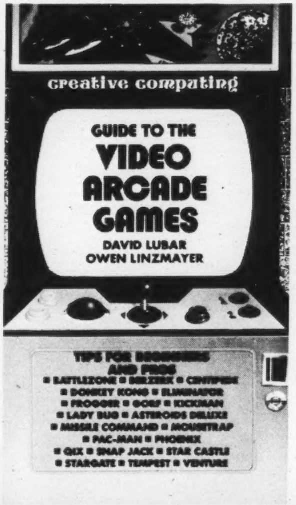
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While there are elements of truth in all these theories, the real reason we buy and read this magazine is to find programming challenges. Has someone published a new game; after I type it in, what can I do to make it work "better"?

Has someone published a program in a language different than the one(s) my computer uses; how can I make the translation? Has someone advertised a new gizmo or widget; how can I produce a super-gizmo, or a widget simulator?

Let's take a case in point. We have all seen the Squiral advertisement for hi-res drawing on the Apple II. The Logo people have used it to prove how easy it

Fred J. Gunther, 9464 Wandering Way, Columbia, MD 21045.

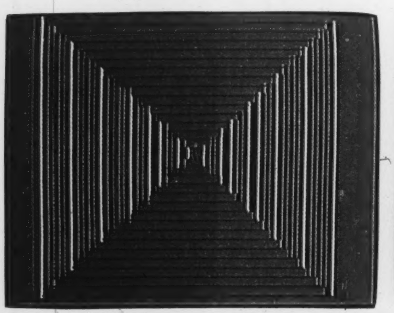


Figure 5.

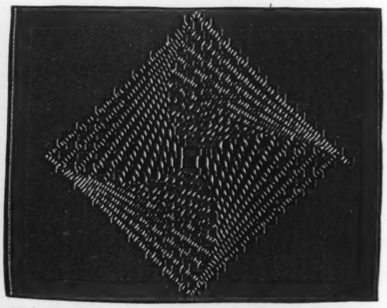


Figure 6.

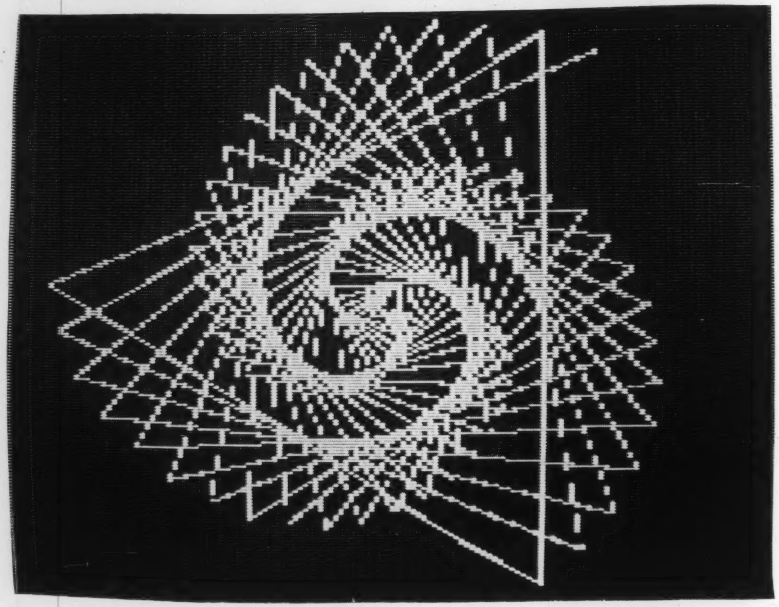


Figure 1.

is to produce graphic designs.

What can be done in one language can be done in another. The challenge is to actually do it. My answer to the Squiral challenge is a program I call Basic Squiral (Listing 1). Written in Applesoft Basic, it will produce many different figures.

Like the Logo version, angle values of 59, 60, 61, or 89, 90, 91, or 118, 120, 123, etc. will produce interesting designs (Figures 1-4). It is even possible to add a little more code, so that the designs are plotted in color, on a color background (Figures 5 and 6).

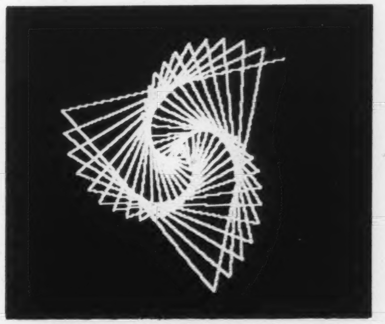
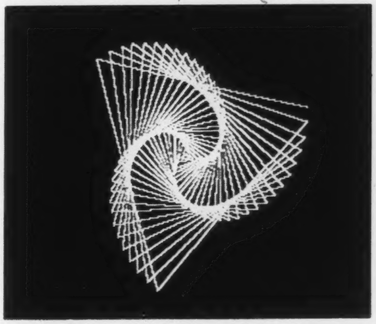


Figure 2.



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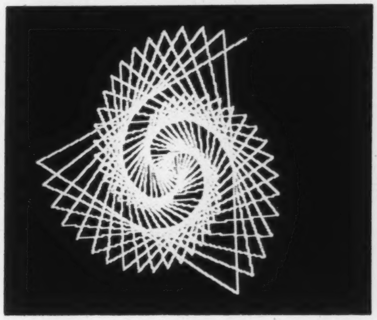


Figure 4.

Editor's Note: Taking the challenge a step farther, we have translated Basic Squiral from Applesoft to TRS-80 Color and Atari Basic. ☐

Listing 1. Applesoft Basic Squiral.

```
10  TEXT : HOME : VTAB 5: PRINT "   *****     BASIC
       SQUIRAL     *****"
20  LET PI = 3.14159:W = PI / 180.: VTAB 15
30  HTAB 12: PRINT "SUPPLY VARIABLES": PRINT : PRINT "
       -- DISTANCE, ANGLE,
     INCREMENT -- ": PRINT : INPUT D,ANG,I
40  HGR2 :X = 140:Y = 96: HCOLOR= 3:A = ANG
50  LET XN = X + D *  COS (W * A):YN = Y + D *  SIN
       (W * A)
60  HPLOT X,Y TO XN,YN
70  LET D = D + I
80  IF D > 200 THEN  STOP
90  LET A = A + ANG
100  LET X = XN:Y = YN
130  GOTO 50
```

Sample run for Applesoft Squiral.

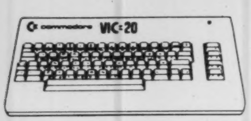
```
]RUN
   *****      BASIC SQUIRAL      *****
            SUPPLY VARIABLES

 -- DISTANCE, ANGLE, INCREMENT --

?1,123,3
```

Listing 2. TRS-80 Color Basic Squiral.

```
10 CLS : PRINT "BASIC SQUIRAL"
20 PRINT : PRINT "SUPPLY VARIABLES:"
30 PRINT "--DISTANCE, ANGLE, INCREMENT--"
40 INPUT D, ANG, I
50 LET PI = 3.14159 : W = PI/180
60 PMODE 4,1 : PCLS : SCREEN 1,1
70 X = 136 : Y= 92 : A = ANG
80 XN = X + D*COS(W*A)
90 YN = Y + D*SIN(W*A)
100 LINE (X,Y)-(XN,YN), PSET
110 IF D>150 THEN 160
120 A = A + ANG
130 X = XN
140 Y = YN
150 GOTO 80
160 A$ = INKEY$ : IF A$<>""THEN RUN
170 GOTO 160
```

Listing 3. Atari Basic Squiral.

```
10 DIM A$(1):REM ATARI TRANSALATION
20 GRAPHICS 8:COLOR 1:TRAP 140
30 PRINT "------BASIC SQUIRALS-------  "
40 PI=3.14159:W=PI/180
50 PRINT "SUPPLY VARIABLES:":PRINT "DISTANCE, ANGLE, INCREMENT"
60 INPUT D,ANG,I
70 X=140:Y=96:A=ANG:PLOT X,Y
80 XN=X+D*COS(W*A):YN=Y+D*SIN(W*A)
90 DRAWTO XN,YN:D=D+I
100 IF D>200 THEN STOP
110 A=A+ANG:X=XN:Y=YN
120 GOTO 80
130 GOTO 75
140 PRINT "WANT TO GO AGAIN";:INPUT A$:IF A$="Y" THEN GOTO 20
```



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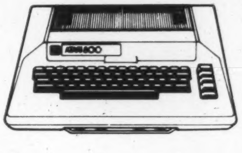

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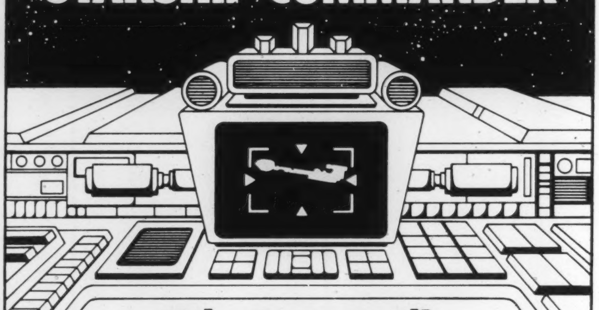

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Brain Warp

Dub Scroggin

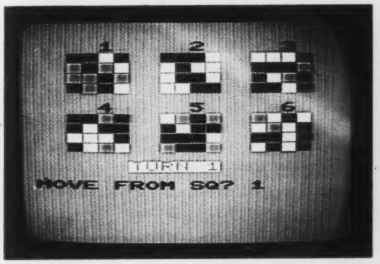
Brain Warp is a puzzle program designed to make use of the sound and color capabilities of the Commodore Vic-20. The program fits in standard Vic memory. The object is to manipulate the rows and columns of six squares and make order out of chaos. Six squares of scattered color are rearranged into six solid-colored squares. Sounds easy, huh? Try it.

There are thousands of paths to a solution and a total of 720 possible solutions. Most solutions will average around 60 moves, though it is possible to reach one in 30 or fewer moves. The more you practice, the better you'll get and the fewer moves you'll require.

Moves are made by specifying a pair of numbered squares and then designating a particular row or column. This row or column is then swapped between the two squares. For example, if squares two and five are specified and the designated row or column is row three, then row three of square two will swap places with row three of square five. This move is depicted in Figure 1.

The puzzle is designed around a three-dimensional array Z(S,R,C), where S is the square number and R and C are the row and column numbers, respectively. There are six squares consisting of four rows and four columns each, hence a total of 96 block positions. Z(2,2,3) designates the third column of the second row, while Z(2,3,4) designates the fourth column of the third row. Both of these squares, as we can see from the first number, are in square two. Rows are horizontal and numbered from top to bottom, while columns are vertical and numbered from left to right. See Figure 2 for an example of the block positions of square two.

Square three would be identical to this, but in each case the first number would be three. Of course, the contents, colors and screen locations would also be different.



TURN 1

MOVE FROM SQ? 1

By holding the square and row numbers constant and varying the column number from one to four, it is possible to isolate a row of a particular square and manipulate it. Holding the square and column numbers constant and varying the row number from one to four, we get the contents of a particular column. Again, Figure 2 should help make this clear.

Initially, the program reads a number into each of the 96 block positions. This number is the color code for the particular location and determines the color of the block. The colors used are black, white, red, cyan, blue, and yellow, and the codes are those found in the Vic manual.

Moving a color code to a different position in the array causes the block at that position to change color. Movements, of course, are made a row or column at a time, rather than by individual block.

Step 20 of the program reserves 96 blocks in memory for the contents of the three-dimensional array and an additional six on which the screen location of each square is based. Step 30 reads the values into these two arrays. K is the column number, J is the row number and I is the square number.

Step 40 puts the square numbers on the screen and marks the start of the main

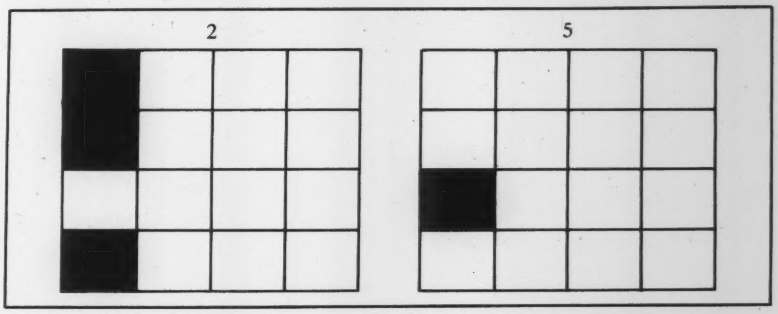


Figure 1. In this example, swapping row three between squares two and five will produce a column of solid black which can then be joined with other such columns to form a black square.

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Brain Warp, continued...

program loop. Steps 50-70 translate the current contents of array Z into the six squares of sixteen blocks each on the screen, as well as providing the double-voiced sound effect.

In step 60 LO(I) is the screen position to the left and above where square I will be placed. Multiplying J by 22 moves down one space. Then, as K goes from 1 to 4, the top row of the square is set in place. When J then changes to 2, we drop to the second row and place its four columns, and so on.

POKEing 207 into each location gives each square its border and sets off the colors. In the latter half of step 60 SC is used to shift to the screen color coding and Z(I,J,K) determines the color of the block just positioned.

Steps 80-100 check for a correct solution by comparing the color of the first block (row one, column one) of each square to each of the other blocks. You may notice a slight delay here, especially as the puzzle nears solution. If a mismatch is found, the triple loop is terminated and the program continues. If no mismatches are found, then the puzzle is solved and step 110 initiates the end-of-game routine starting at line 3000.

To test the end-of-game routine you may temporarily change 120 in line 90 to 110. The program will then go directly to the end-of-game routine on a mismatch.

Beginning in step 130 and ending with the end of the main program loop in step 210, the user inputs the pair of squares and the row or column he wants to swap between them. The swaps are actually made in step 180 for rows or in step 200 for columns.

To swap rows, I hold the square and row number constant and vary the column number using M. F and T represent the input "from" and "to" squares, respectively, while R is the input row number to be swapped. The contents of Z(F,R,M) are temporarily placed in HO while the contents of Z(T,R,M) are moved to Z(F,R,M). The contents of HO are then placed in Z(T,R,M) and the swap is completed. A similar method is used for swapping columns.

Step 210 keeps count of the number of moves and marks the end of the main program loop. Control passes back to step 40 and the screen is set up for your next move.

Steps 1000-1050 are the contents of the LO array and the initial contents of the Z array. LO is the first number, while the next 16 are the color codes for that square. If, in trying to solve the puzzle, you run into a non-solvable setup, check to be sure these numbers are correct. Certain arrangements will preclude a solution, but not give an error message to tell you about it.

These values were obtained by setting up a solution, i.e., making the numbers for square one all zeros, etc., then using the program to scramble the squares. I then recorded the result, translated to the color codes and altered the data. The same method may be used to change the initial setup, but the values should not be altered haphazardly.

Steps 2000-2110 are the title display and direction subroutine called by line 10. The value of P in step 2010 is used to

LO(2)= 7732	SQUARE 2			
	Col. #1	2	3	4
Row # 1	7755 Z(2,1,1)=2 red	7756 Z(2,1,2)=0 black	7757 Z(2,1,3)=2 red	7758 Z(2,1,4)=7 yellow
2	7777 Z(2,2,1)=7 yellow	7778 Z(2,2,2)=6 blue	7779 Z(2,2,3)=7 yellow	7780 Z(2,2,4)=7 yellow
3	7799 Z(2,3,1)=7 yellow	7800 Z(2,3,2)=2 red	7801 Z(2,3,3,)=0 black	7802 Z(2,3,4)=1 white
4	7821 Z(2,4,1)=7 yellow	7822 Z(2,4,2)=1 white	7823 Z(2,4,3)=6 blue	7824 Z(2,4,4)=0 black

Figure 2. This figure illustrates the block positions for square two and shows how they are numbered. It also gives the initial contents and corresponding colors for each block. The top number in each block is the screen location based on LO(2).

create the sound and color display at the start of the program run.

Steps 3000-3100 are the end-of-game subroutine called by line 110. Location 36864 (H), which normally contains 5, is altered to produce the horizontal movement, while 36865 (normally 25) is altered to get vertical movement. These numbers are swapped back and forth in steps 3050 and 3060.

Step 3080 sets the value of A$, and step 3090 causes it to be printed one letter at a time. Step 3100 changes the screen and cursor to purple, causing the word "ready" and the cursor to be invisible. Pressing the CTRL key and one of the other keys will cause the cursor to reappear.

I have included Remarks in the program listing as an aid to understanding it, but recommend they not be typed in, because of the memory they consume.

Good luck, and I hope you enjoy Brain Warp. ☐

Variable Listing

SC	Difference between screen and color locations
CI	Count turns
H	Horizontal screen center
H+1	Vertical screen center
G	Used to set values of H and H+1
V	Volume (36878)
Z(S,R,C)	Puzzle array where S=square number, R=Row number, C=Column number. Value is color code for specified location
LO(S)	Location on screen on which position of square is based
I,J,K	For-next indexes used with array Z
F	Square moving from
T	Square moving to
W$	Used to specify whether you want to move a row or a column
R	Row to be swapped
C	Column to be swapped
M	For-next index used in swaps
HO	Auxiliary variable used in making swaps
P	For-next index used for pauses and in special effects
S,Y	For-next index controlling screen movement in end-game routine
A$	End-game message

Listing 1.

```
 5 REM--BRAIN WARP BY DUB SCROGGIN,404 WOODROW ST.,FT. WALTON
   BEACH,FL 32548
10 PRINT"J":SC=30720:CI=0:H=36864:G=5:V=36878:GOSUB2000
20 DIMZ(6,4,4),LO(6)
30 FORI=1TO6:READLO(I):FORJ=1TO4:FORK=1TO4:READZ(I,J,K):NEXTK,J,I
40 PRINT"■■■■     1     2     3":PRINT"■■■■■■    4     5     6":
   PRINT"■■"
50 POKEV,15:FORI=1TO6:POKEV-4,135+8*I:FORJ=1TO4:POKEV-2,225+I*J-
   CI:FORK=1TO4
60 POKELO(I)+J*22+K,207:POKELO(I)+SC+J*22+K,Z(I,J,K)
70 NEXTK,J,I:POKEV-2,0
80 FORI=1TO6:FORJ=1TO4:FORK=1TO4
90 IFZ(I,1,1)<>Z(I,J,K)THEN120
100 NEXTK,J,I
110 POKEV-4,0:POKEV,0:PRINT"■■■■   YOU GOT IT IN";CI:PRINT"
           MOVES.":GOSUB 3000
120 POKEV,0:POKEV-4,0:PRINT"■■         ■■TURN";CI+1;"■■■"
130 INPUT" MOVE FROM SQ  1■■■";F:IFF<1ORF>6THENPRINT"J
                         J":GOTO130
140 INPUT" MOVE TO SQ    1■■■";T:IFT<1ORT>6THENPRINT"J
                         J":GOTO140
150 INPUT" ROW OR COL    R■■■";W$
160 IFW$="C"THEN190
170 INPUT"J ROW NUMBER    1■■■";R:IFR<1ORR>4THENPRINT"J
                         ":GOTO170
180 FORM=1TO4:HO=Z(F,R,M):Z(F,R,M)=Z(T,R,M):Z(T,R,M)=HO:
    NEXTM:GOTO210
190 INPUT"J COL NUMBER    1■■■";C:IFC<1ORC>4THENPRINT"J
                         ":GOTO190
200 FORM=1TO4:HO=Z(F,M,C):Z(F,M,C)=Z(T,M,C):Z(T,M,C)=HO:NEXTM
210 CI=CI+1:PRINT"J":GOTO40
220 END
1000 DATA7726,0,6,7,2,3,2,3,1,3,3,2,3,6,3,0,7
1010 DATA7732,2,0,2,7,7,6,7,7,7,2,0,1,7,1,6,0
1020 DATA7738,7,1,1,0,2,0,6,3,6,1,3,0,0,2,7,6
1030 DATA7858,6,2,3,6,0,1,0,2,1,7,1,2,2,7,3,1
1040 DATA7864,1,3,0,3,6,7,2,6,2,0,6,7,3,6,2,3
1050 DATA7870,3,7,6,1,1,3,1,0,0,6,7,6,1,0,1,2
2000 PRINT"J■■■■■■■■■■     BRAIN WARP       ":PRINT"■■■■■■■■■■■
      BY DUB SCROGGIN "
2010 POKEV,15:FORP=1TO100:POKEV+1,P*2+24:POKEV-4,200+INT(P/2):
     POKEV-3,200+INT(P/2)
2020 NEXTP:POKEV+1,136:FORP=1TO800:NEXTP:PRINT"■■      DIRECTIONS
        ■"
2030 PRINT"THE COMPUTER WILL SET UP 6 SQUARES OF COLOR BLOCKS."
2040 PRINT"■YOUR JOB IS TO MAKE   EACH BLOCK A SOLID    COLOR
     IN AS FEW MOVES"
2050 PRINT"AS POSSIBLE BY EX-    CHANGING A ROW OR A   COLUMN
     IN ANY TWO"
2060 PRINT"SQUARES AS MANY TIMES AS YOU WANT."
2070 PRINT"■(ROWS ARE HORIZONTAL  AND NUMBERED 1-4)"
2080 PRINT"(COLUMNS ARE VERTICAL)":POKEV,0:POKEV-4,0:POKEV-3,0
2090 PRINT"■■ HIT ANY KEY TO START ■"
2100 GETA$:IFA$=""THEN2100
2110 PRINT"J":RETURN
3000 FORY=1TO4:POKEV,15:FORP=1TO20:POKEV-2,190+P*2:POKEV-3,190+P*2
3010 FORS=GTOG-5STEP-1:POKEH,S:NEXTS
3020 FORS=G-5TOG+5:POKEH,S:NEXTS
3030 FORS=G+5TOGSTEP-1:POKEH,S:NEXTS
3040 POKEV+1,136+INT(P/4):NEXTP
3050 IFH=36865THENH=H-1:G=5:NEXTY:GOTO3070
3060 H=H+1:G=25:NEXTY
3070 POKEV,0:POKEV-2,0:POKEV-3,0
3080 FORP=1TO2000:NEXTP:PRINT"■   ■";:A$="CONGRATULATIONS!"
3090 FORI=1TO16:PRINTMID$(A$,I,1);:FORP=1TO200:NEXTP,I
3100 FORP=1TO2000:NEXTP:POKEV+1,76:PRINT"■":END
```

"Don't you think you've played enough 'star trek' for today?"

APPLICATIONS SOFTWARE

GRAPHICS AND MUSIC

Graphmagic creates diagrams from mathematical data. Pie charts, line graphs, bar graphs, and scatter diagrams are among the options. The program is compatible with DIF data, costs less than $100, and requires an Apple II with a disk drive. International Software Marketing, 120 E. Washington St., Suite 421, University Bldg., Syracuse, NY 13202.

CIRCLE 400 ON READER SERVICE CARD

The **Game Application Package** makes it possible for Applesoft programmers to program animated graphics. It costs $49.95 and requires DOS 3.3, 48K, and Applesoft. Synergistic Software, 830 North Riverside Dr., Suite 201, Renton, WA 98055.

CIRCLE 401 ON READER SERVICE CARD

Micromap II is used on a microcomputer to make maps: colored and textured area maps, contour maps, 3-D polyhedron or proportional circle maps, and statistical charts and graphs and perspective views of digital terrain models. Micromap II is written in Applesoft and requires 48K of memory, Apple DOS 3.3, and one 5-1/4" disk drive. $650. The discrete mapping and contour sections are $350. Morgan-Fairfield Graphics, P.O. Box 5457, Seattle, WA 98105. (206) 632-1374.

CIRCLE 402 ON READER SERVICE CARD

Musicbox is a package for Atari owners who write their own programs. The disk contains six programs: Convert, Playtest, Colorgan, Musicbox, Translat, and Data Files. Musicbox is available for Atari computers with a memory of at least 32K. $29.95. Program Design, Inc., 11 Idar Court, Greenwich, CT 06830. (203) 661-8799.

CIRCLE 403 ON READER SERVICE CARD

Grappler Plus is an Apple printer interface that combines on-board firmware for Apple hi-res graphics, with other features such as Apple III compatibility, an on-board dip switch for printer selection, and Orange Micro's Dual Hi-Res Graphics. A single Grappler Plus interface is compatible with the NEC 8023, Centronics 739, C. Itoh Prowriter, Anadex, Okidata, Datasouth DS-180 and the line of Epson printers. Also it is Apple, Pascal, CP/M, and Logo compatible. Orange Micro, Inc., 3150 E. La Palma, Suite G, Anaheim, CA 92806. (714) 630-3620.

CIRCLE 404 ON READER SERVICE CARD

Hiresl and **Hires2** are high-speed, high-resolution drivers for 48K or 16K LNW-80 computers. They use the 480 x 192 graphics capability of the LNW. Features included are: LINE draw/erase, CIRCLE draw/erase, check DOT on/off, TONE generation, and a character table for 80 x 16 or 80 x 24 text display. The length of both drivers is less than 2500 bytes. They come with five demonstration programs, and are available on cassette or single-density diskette. $20. Emert/Hummel Software, 4943 Antioch Blvd., Baton Rouge, LA 70816. (504) 293-3400.

CIRCLE 405 ON READER SERVICE CARD

The **Fig Factory** is a hi-res graphics utility which allows the user to sketch on-screen with the Apple III computer. Over 100 symbols can be sketched, and up to five pictures on each diskette can be retrieved. It requires the 128K-1 external disk drive with optional joystick and Silentype printer. $49.95. Sun Software, P.O. Box 189, Tustin, CA 92680. (714) 559-1390.

CIRCLE 406 ON READER SERVICE CARD

GAMES, RECREATIONAL

Radio Shack has released **Games II** for the TRS-80 Pocket Computer. Eight game programs challenge deductive reasoning, marksmanship, and gambling talents. The package includes Missile Marksman, Baccarat, Blackjack, Aceydeucey, One-Armed Bandit, Pokerslot, Numguess and Craps. Two cassettes retail for $14.95. Tandy Corporation, 1800 One Tandy Center, Fort Worth TX 76102.

CIRCLE 407 ON READER SERVICE CARD

Firebug, from Muse Software, is a new game by Silas Warner. The scenario puts you, the Firebug, at the top of a five-story maze, complete with burning fuse, gasoline cans, and the dare to burn down the floors one at a time. The game runs on the Apple II or Apple II+ with 48K and disk drive, and costs $24.95. Muse, 347 N. Charles St., Baltimore, MD 21201.

CIRCLE 408 ON READER SERVICE CARD

Star ships confront alien attack ships and an intergalactic leech in **K-Star Patrol**. The package contains one ROM cartridge and a 12-page color instruction booklet. The cartridge fits Atari 400 and 800 Personal Computer Systems. K-Byte, Division of Kay Enterprises Co., 1705 Austin St., Troy, MI 48084. (313) 524-9878.

CIRCLE 409 ON READER SERVICE CARD

Alien Garden is a strategy-action game in which the player must eat life-giving crystals while avoiding death-making crystals. The game sells for $39.95 in cartridge form and requires an Atari 400 or 800. Epyx, P.O. Box 4247, Mountain View, CA 94040.

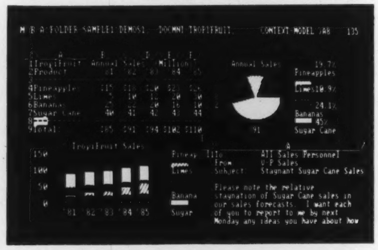
CIRCLE 410 ON READER SERVICE CARD

King Cribbage is a new version of the age old English card game. The King plays six-card cribbage as dealt from a standard 52-card deck. The program retails for $24.95 and requires an Apple II, 48K, and a disk drive. Hayden Book Company, 50 Essex St., Rochelle Park, NJ 07662.

CIRCLE 411 ON READER SERVICE CARD

BUSINESS

The **Context MBA** incorporates spreadsheet, word processing, graphics, and database functions in one package. A telecommunications feature will soon be added and will be provided as a no-cost upgrade to early buyers of the package.



```
M B A:FOLDER SAMPLE1 DEMOS1  DOCMNT TROPIFRUIT   CONTEXT MODEL ZA8   135

   A          B    C    D    E    F
1TropiFruit  Annual Sales (Million)          Annual Sales         19.7%
2Product      '81  '82  '83  '84  '85                             Pineapples
3
4Pineapples   $15  $18  $20  $23  $26                             Limes10.9%
5Limes          5   10   12   20   30
6Bananas       25   22   20   16   10                               24.1%
7Sugar Cane    40   41   42   43   44                             Bananas
8                                                                   45%
9Total:       $85  $91  $94 $102 $110          91                 Sugar Cane

        TropiFruit Sales
150                            Pineap  To:       All Sales Personnel
                                       From:     V-P Sales
100                            Limes   Subject:  Stagnant Sugar Cane Sales
 50
                                       Please note the relative
                               Banana  stagnation of Sugar Cane sales in
  0                                    our sales forecasts.  I want each
     '81 '82 '83 '84 '85       Sugar   of you to report to me by next
                                       Monday any ideas you have about how
```

The system requires an IBM Personal Computer, 256K, 2 disk drives, and color graphics card. Context Management Systems, 23864 Hawthorne Blvd., Suite 100, Torrance, CA 91604.

CIRCLE 412 ON READER SERVICE CARD

Servicemanager is a business software package which performs administrative and clerical chores for repair shops and service departments. It has word processing capability and prints all standard forms. It runs on the Apple III with the ProFile hard disk or 5-1/4" diskettes. The Denver Software Company, 14100 E. Jewell Ave., Suite 15, Aurora, CO 80012. (303) 750-9980.

CIRCLE 413 ON READER SERVICE CARD

The Execuware **Economic Order Quantity** package is a cost control software package for use with the Apple II, Apple II plus, and IBM personal computers. Execuware minimizes inventory costs while maintaining ideal stocking levels. Microcomputer Software Division of Aeronca, Inc., 4530 Park Rd., Suite 348, Charlotte, NC 28209. (704) 525-9881.

CIRCLE 414 ON READER SERVICE CARD

VersaForm Business Form Processor allows a nonprogrammer to set up business forms on the Apple computer, to store them as files, and to generate analyses and management reports for their data. VersaForm may be installed on Apple systems using ProFile, Corvus, and other hard disks supporting the Pascal operating system. Both Apple II and Apple III versions have 80-column screen formats. $495. Applied Software Technology, 14125 Capri Dr., Los Gatos, CA 95030. (408) 370-2662.

CIRCLE 415 ON READER SERVICE CARD

The Accountant Finance Database System is a double entry system that permits those who are not familiar with accounting terminology to use the double entry process. It requires an Apple II computer with 48K of RAM and can operate with one or two disk drives. Decision Support Software, 1438 Ironwood Dr., McLean, VA 22101. (800) 368-2022.

CIRCLE 416 ON READER SERVICE CARD

The TRS-80 **Expense Ledger** is for business/personal payments and keeps a one disk record of payments made during any year or part-year period. Entries can be reviewed by part-screen scrolling, edited, deleted or added to, and machine-language sorting puts entries into date order. The program is for TRS-80 Models I and III, and is available in 48K (470 entries) and 32K (200 entries) versions. $35. Manhattan Software, P.O. Box 1063, Woodland Hills, CA 91365. (213) 704-8495.

CIRCLE 417 ON READER SERVICE CARD

The **Prompt Accurate Cost Estimator** is a flexible general purpose estimating product which aids in appraising and estimating equipment, labor, material, and general project needs. P.A.C.E. requires a 64K IBM-PC with the IBM UCSD p-system or a 64K Apple II or 128K Apple III with Apple Pascal. All versions require a 132-column printer. $395. High Technology Software Products, Inc., P.O. Box 14665, 2201 N.E. 63rd St., Oklahoma City, OK 73113. (405) 478-2105.

CIRCLE 418 ON READER SERVICE CARD

An Apple II medical applications software system, **Automated Medical Administrator**, is designed to automate the accounts receivable and claim form preparation tasks of the multi-doctor medical practice. The system allows for the maintenance of up to 200,000 accounts for up to ten physicians. Boardroom Executive Software, Suite 240, Airport Park Plaza, 255 North El Cielo Rd., Palm Strings, CA 92262. (714) 365-6770.

CIRCLE 419 ON READER SERVICE CARD

A **Business Bookkeeping System** for small businesses is a set of menu-driven ledgers that allows the user to switch to an accrual system later. Some of the features are three cash basis activity ledgers, a complete general ledger, a security password for accessing employee information, and other reports. Dakin 5 Corporation, P.O. Box 21187, Denver, CO 80221. (303) 426-6090.

CIRCLE 420 ON READER SERVICE CARD

Inventory Manager is an inventory control software package for the Apple II computer. It can deal with 2700 different inventory items on a two disk system, and

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New Products, continued...

can break the items down into 13 different categories. Inventory Manager issues reports which summarize profit margins, calculate wholesale to retail mark-ups, list back order status, print purchase orders, and more. $149.95. **Integer Basic Compiler** is a utility software program for the Apple II computer with Integer Basic. Standard features include full support of hi-res and lo-res graphics and full support of lower case characters, disk error recovery, CHR$, GET, and KEY functions. The IBC requires an Apple II computer, 48K, DOS 3.3, and one disk drive. $149.95. Synergistic Software, 830 N. Riverside Dr., Suite 201, Renton, WA 98055. (206) 226-3216.

CIRCLE 421 ON READER SERVICE CARD

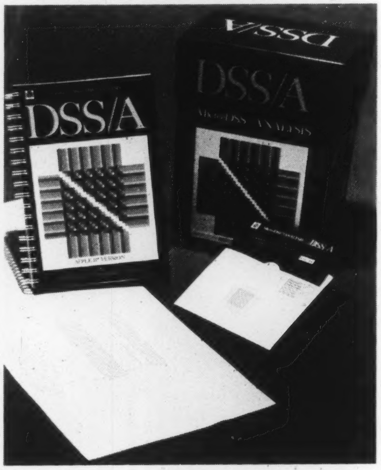
Loan Sales/Purchase Analysis is a program for analyzing the sale or purchase of a loan. Loans of any amount, bearing any interest rate and due date can be handled by this program. Loans in foreign currencies may be analyzed as well as loans in U.S. dollars. Loan Sales/Purchase Analysis is available on diskette or cassette for the Apple II or III and TRS-80 Model I or III. $50. Realty Software Company, 1116 'E' 8th St., Manhattan Beach, CA 90266. (213) 372-9419.

CIRCLE 422 ON READER SERVICE CARD

The **Integrated Business Information System** is a set of accounting packages designed for the DEC VT180 and the Rainbow, DECmate II and Professional Series computers. IBIS is for professional accounting firms, bookkeeping agencies, and small businesses. It generates user defined financial statements and more than 25 printed reports for financial analysis and planning. PDS Microsystems, P.O. Box 5369, Carson, CA 90749. (213) 538-3982.

CIRCLE 423 ON READER SERVICE CARD

The Micro-DSS/Analysis software package is a support tool that enables managers, analysts, and policy administrators to handle information for planning, evaluation, and reporting. It is available for the 48K Apple II with Pascal, two floppy disk drives, monitor, and printer. $495. Addison-Wesley Publishing Company, Inc., Jacob Way, Reading, MA 01867. (617) 944-3700.



CIRCLE 424 ON READER SERVICE CARD

Ag/Pac is an agricultural software package which enables the user to view a wide range of alternatives in common agricultural problem areas. Ag/Pac consists of 80 agricultural programs packaged in 32 modules, and will run on most microcomputers. Wisconsin Microware, One South Park St., Suite 220, Madison, WI 53715. (608) 255-9020.

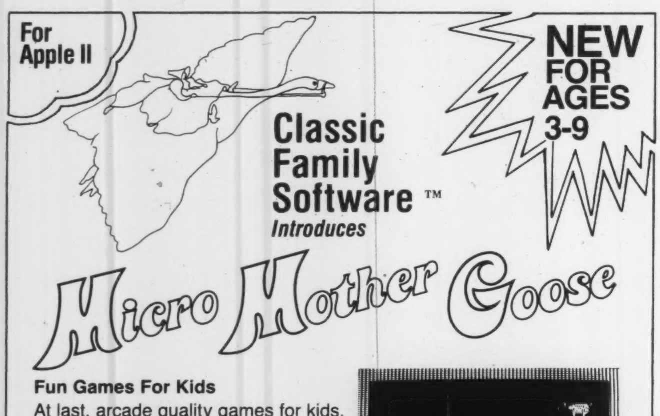
CIRCLE 425 ON READER SERVICE CARD

WORD PROCESSING

Footprint! is a text formatting program which is compatible with any text editor and computer and for which a Pascal compiler is available. It can be used by law firms and businesses of any size in their word processing centers. A single user license for a microcomputer configuration is $200. Alexander Hamilton Institute, Inc., 1633 Broadway, New York, NY 10019. (212) 619-3346.

CIRCLE 426 ON READER SERVICE CARD

Copyart II is a word processor that offers graphics, math, sorting, and mail-merge utilities. Columns may be created for journals and reports, and Copyart II can be used to edit Basic programs. The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2357 Southway Drive
P.O. Box 21341
Columbus, OH 43221
(614) 486-3563

CIRCLE 265 ON READER SERVICE CARD

program runs on the TRS-80 Model I and III or LNW. $149.95. Simutek Computer Products Inc., 4897 E. Speedway Blvd., Tucson, AZ 85712. (602) 323-9391.

CIRCLE 427 ON READER SERVICE CARD

PERSONAL

Quikcalc Real Estate Investor is a real estate financial analysis package for 8" CP/M systems. It requires SuperCalc and a minimum of 64K, and is used on the Apple and IBM Personal Computers with VisiCalc. Two models, individual residence and income property, are available. $129.95. Simple Soft, Inc., 480 Eagle Dr., Suite 101, Elk Grove, IL 60007. (312) 364-0752.

CIRCLE 428 ON READER SERVICE CARD

Market Analyst is a software package for the stock market investor. The system features Technical Analyst for computerized charting, Portfolio Manager to monitor holdings, and News, Views and Quotes for on-line information access. It runs on an Apple II/II Plus equipped with a 16K RAM card, a color or black and white monitor, and one or more disk drives. $295. Anidata, 613 Jaeger Ct., Sicklerville, NJ 08081.

CIRCLE 429 ON READER SERVICE CARD

Darkstar provides advice on matters pertaining to the darkroom. It is available for the Sinclair ZX81, Apple II and Atari on either tape or disk. $129.95. F/22 Press, P.O. Box 141, Leonia, NJ 07605. (201) 568-6250.

CIRCLE 430 ON READER SERVICE CARD

UTILITIES AND MISCELLANEOUS

Synergistic Software has released **The Programmer's Workshop**, a new utility series for the 32K Atari 400/800 computer with one disk drive. The package consists of seven separate programs designed to assist in programming. $34.95. Synergistic Software, 830 North Riverside Dr., Suite 201, Renton, WA 98055.

CIRCLE 431 ON READER SERVICE CARD

Macro-80C is a macro assembler, screen-oriented editor, and machine language monitor for the Radio Shack Color Computer. 16K and a Radio Shack disk drive are required. The price is $99.95. Micro Works, P.O. Box 1110, Del Mar, CA 92014.

CIRCLE 432 ON READER SERVICE CARD

The Filer is an Apple utility system for 35-, 40- and 70-track drives. It contains a disk drive speed check, disk drive test, fast copy program, and a file manager. Options include: Catalog with space on disk, Copy files, Copy disk, Copy DOS, Delete, Lock and Unlock Files, and Change Booting Program. $19.95. Central Point Software, Inc., P.O. Box 19730-#203, Portland, OR 97219. (503) 244-5782.

CIRCLE 433 ON READER SERVICE CARD

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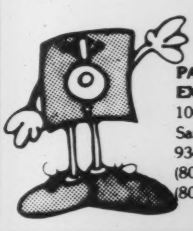

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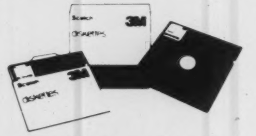

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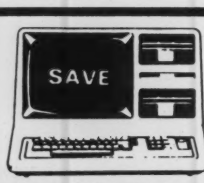

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VIZ.A.CON can add a third dimension to VisiCalc models. It can combine multiple pages of VisiCalc data from a model for consolidation or for summations over periods of time. VIZ.A.CON runs on the Radio Shack TRS-80 Model I/III. $89.95. Abacus Associates, Suite #240, 6565 W. Loop So., Bellaire, TX 77401. (713) 666-8146.

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Seven software programs are available for the IBM-PC with 48K memory, one disk drive, DOS and disk Basic, and either monochrome or color graphics. **String Sort** is a machine language sort routine that will sort any string array into ascending alphabetical order. $24.95. **Electronic Disk** permits the use of expanded capacity disk drives and allows RAM memory to be used as an electronic disk drive and a printer spooler. $69.95. **ISAM Database** provides keyed access to data files for reading, writing, updating, and deleting records within the file. $69.95. **Cross Reference** lists alphabetically all variables and the line numbers where the variables occur. The program may be saved on disk in either ASCII or binary format. $24.95. **Games Package 1** is a collection of ten games including Qubic, Othello, Cribbage, Space Trek, Black Jack, Master Mind, Americans Quiz and others. $29.95. **HP7470 Plotter Demo** has nine demonstration programs including 12-Month Trend and Phone Chart. $24.95. **Bowling League Statistics Manager** maintains all bowling league statistics and memberships, computes individual handicaps and team standings, and prints reports. $99.95. Ensign Software, 2312 N. Cole Rd., Suite E, Boise, ID 83704. (208) 378-8086.

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CatalogCard and LabelWriter is an Apple II program that generates catalog cards and spine labels. The program requires a standard 80-column printer (Epson, Centronics, Microline, etc.), a lower case adaptor, and continuous-form cards and labels. The program is available on a 30-day on-approval basis for $199 with a lower case adaptor and $169 without the adaptor. The **Library Circulation Management Program** is for the TRS-80 and Apple II. It is for small school libraries, and records information for 300 students borrowing up to six books each.

The system requires a 32K TRS-80, Model III or Model II, or Apple II with at least one disk drive and any 80-column printer. $240. K-12 MicroMedia, 172 Broadway, Woodcliff Lake, NJ 07675. (201) 391-7555.

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Diskovery is an Apple disk utility package that supports 35-, 40-, 70-, and 80-track drives in 13- and 16-sector formats including CP/M and Pascal. Diskovery includes several programs for repairing damaged diskettes, undeleting files, testing drive speed, and more. A 130-page manual is included in the $59.95 price. Micro Mantic Computer, 541 N.E. McWilliams Rd., Bremerton, WA 98310. (206) 373-9231.

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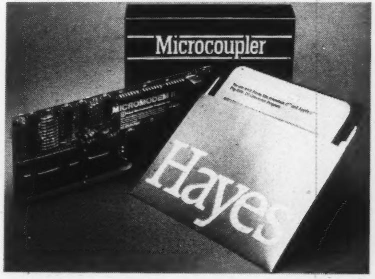
Basic Aid is an enhancement to the TRS-80 Color Computer. It contains features such as automatic line numbering and single key entry of most Basic commands. The Merge command allows Basic routines stored on cassette to be merged with the program in memory. The Move Line command allows any program line or lines to be moved anywhere and renumbered. Basic Aid comes in a ROM cartridge. $39.95. Eigen Systems, Box 10234, Austin, TX 78766. (512) 837-4665.

CIRCLE 439 ON READER SERVICE CARD

Apple computer users can plug into the Prestel World Videotex Service with an **Appletel Disk**. This software turns the personal computer into a terminal to retrieve international data including updated prices of commodities, currency exchange and IMM rates, and stocks. Other useful databases include financial/management information, economic indicators, locations of deep sea ships, hotel bookings, and international news, sports, and weather. Logica/BVT, 666 Third Ave., New York, NY 10017. (212) 599-0828.

CIRCLE 440 ON READER SERVICE CARD

The **Terminal Program** for the Hayes Micromodem II and Apple II is a software package for communicating over telephone lines with other computers. It originates and answers calls; creates, lists, sends, and receives files; and manages communications parameters. It is compatible with three Apple operating systems: DOS 3.3, Pascal, and CP/M. The



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CIRCLE 209 ON READER SERVICE CARD

New Products, continued...

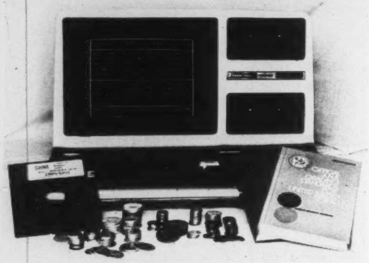
program supports up to six disk drives, several printer interface cards, 40- and 80-column screens, and lower case characters through hardware modifications. The Micromodem II system connects directly to the telephone line. The terminal program is $79, and the Micromodem II package is $399. Hayes Microcomputer Products Inc., 5835 Peachtree Corners East, Norcross, GA 30092. (404) 449-8791.

CIRCLE 441 ON READER SERVICE CARD

Key-Wiz is a multi-key search utility designed to search a file of index cards and find all entries which match a profile of keywords. Included with Key-Wiz is Sort-Wiz, a utility that provides a way to sort the data files. Key-Wiz is available in ABS or COM format on a 5-1/4" hard sector diskette for HDOS or CP/M and may be used on a Heath H8 or Heath/Zenith H89 with 48K memory. $19.95. Interactive Micro Systems, P.O. Box 21007, Columbus, OH 43221. (614) 363-1534.

CIRCLE 442 ON READER SERVICE CARD

Computerized Inventory System is a computer program for coin collectors. Coins is intended to run on either the TRS-80 Model I or Model III, 48K, with two disk drives. An updated value file is included. $95. Compu-Quote, 6914 Berquist Ave., Canoga Park, CA 91307. (213) 348-3662.



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Platinum **Worksaver** is a programming aid that is designed for the 16K TRS-80 Color Computer and occupies less than 2K of memory. It provides full screen editing of Basic programs with automatic line numbering, changes, deletes, and inserts, using a movable cursor. $30. Platinum Software, P.O. Box 833, Plattsburgh, NY 12901. (518) 643-6796.

CIRCLE 444 ON READER SERVICE CARD

EZ-Camp is a set of programs designed for camp management. This system maintains complete camper information and can produce mailing lists, medical records, bunk lists, and other camp reports. It is to be used on the TRS-80. $50. EZR Micro, Inc., 11 Conwell Dr., Maple Glen, PA 19002.

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MergeCalc merges VisiCalc files and extends the utility of VisiCalc. It runs on Apple II Plus and the IBM PC. It can have up to 15 files, is menu driven, has individual rows and columns, and is not memory dependent. $125 for the Apple II Plus MergeCalc. Cypher, 121 Second St., San Francisco, CA 94105. (415) 974-5297.

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Swift is an interface between WordPro and database packages such as Jinsam, mailing list packages such as Sipper, and other word processors such as Papermate. Swift translates sequential files into WordPro-readable text files. It is designed to run on the Commodore 8032 CBM computer with 8050 disk drives. Ini, Inc., 4013 Chestnut St., Philadelphia, PA 19104. (215) 386-7994.

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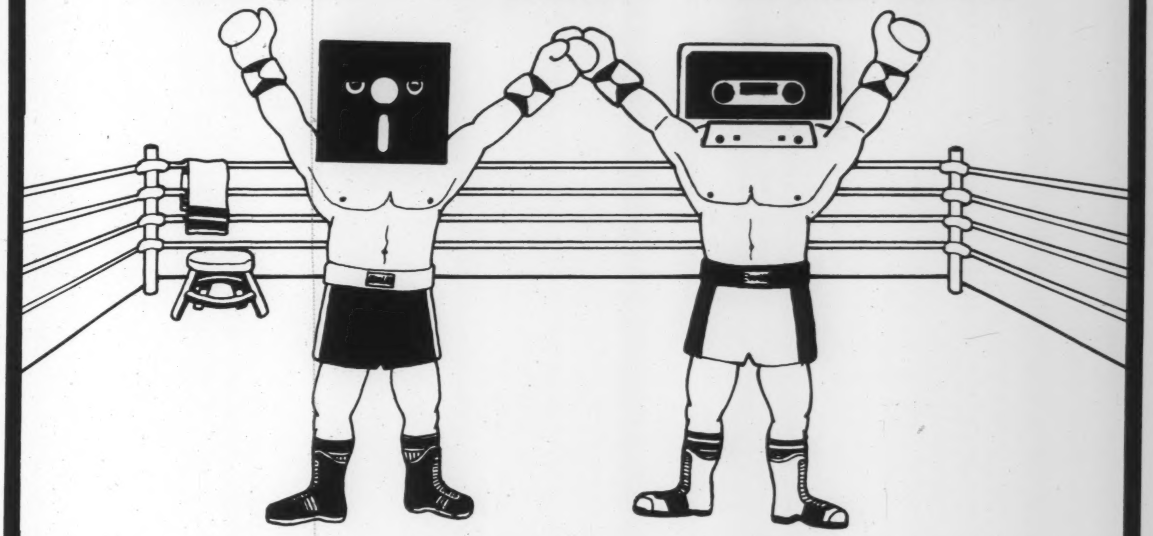

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CIRCLE 133 ON READER SERVICE CARD

Part Seven: Scrolls and Other Creatures

The Graph Paper

David Lubar

Last month, we covered some methods of screen manipulation and took a preliminary look at character graphics. This time, we'll go deeper into character graphics and cover some other types of screen manipulation, such as scrolling. If you haven't already made a copy of the lookup table listed in the last issue, I'd suggest doing so now, since it will be used extensively from here on.

The question of the month comes from Avis N. Wyatt, Jr., who asks "How can you print on the high resolution screen?" Several methods are discussed below.

The Art of Text

The simple example of character graphics listed last month covered the basic concept of placing a series of bytes on the screen to form an image. The strength of this method is that each image uses little memory and each shape can easily be placed on the screen.

The disadvantage is that minimum horizontal motion is limited to steps of one byte, causing the image to jump seven pixels whenever it moves. While this may seem like a large jump, it works well in some programs. There are actually many programs on the market that move objects two bytes at a time.

If the object is large enough, the result is still smooth animation. Next month, we'll go into smooth, single bit movements. For now, we'll look at various applications of character techniques.

There are two main uses for character graphics. One, as mentioned, and as demonstrated last month, is animation. The other, more crucial application is for placing text on the graphics screen. In the old days, games usually put all text on the bottom four lines, making use of the Apple text window. Nowadays, messages appear all over the place, in various fonts.

Text messages can be broken into two types: dedicated blocks and character sets. A dedicated block is a message that doesn't change, such as the phrase HIGH SCORE. A phrase such as this can be saved as a group of bytes, and then can be placed on the screen wherever it is needed. There is no reason to develop a whole character set for such a message. To do so would be analogous to primitive printing methods where whole words were carved from wood.

Listing 1 shows a general program for placing a message on the screen. To use the routine, just pass the desired coordinates and the routine will place the block of bytes on the screen. See Figure 1 for an example of how the byte pattern for the message was composed. Note that the routine doesn't check for screen boundaries. Since this is an important consideration, I'll take a short sidetrip into the topic now.

Checking For Screen Boundaries

When an object goes past the edge of the screen, it should either disappear or wrap around. Unlike Applesoft shape tables, here the programmer has control of what happens. But if you aren't careful, you can blow your whole program away and hang the system in various nasty manners. The lookup table we use contains a hi byte and lo byte for each line of the screen. But if your program tried to use the table for a location greater than #$BF

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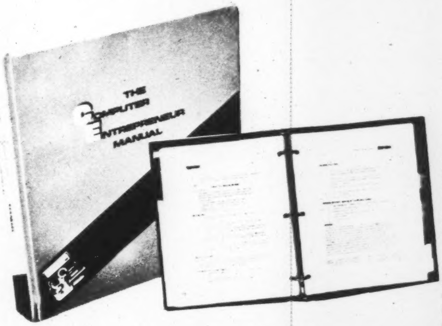

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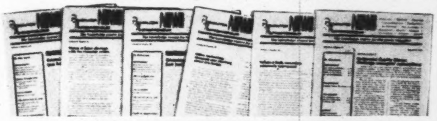

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CIRCLE 304 ON READER SERVICE CARD

(the last line of the screen), it would produce an address that might be anywhere in memory. It would grab a hi byte from the beginning of the lo byte table, and a lo byte from somewhere past the end of the lo byte table.

If the resulting address were to be used as a pointer, you might end up placing bytes in undesirable areas.

Objects that go past the screen horizontally are not as disastrous, but can be unattractive since they don't wrap smoothly but appear on the next memory location which, as you know, is not the next screen location.

There are two ways to handle these problems. The first is to pad out the lookup table. Since each table is only 192 bytes long, and the 6502 registers can index 256 bytes, the rest of the table can be padded with harmless addresses.

As mentioned last month, there are certain unused portions of the screen, and objects that go past the bottom line can safely be placed in them. If the lo byte table is padded with values of $F8 and the hi byte table padded with $20, shapes that go past the bottom of the screen will be placed in the undisplayed portion of memory starting at $20F8. This works fine as long as the shape occupies no more than eight bytes per line.

A better method is to check coordinates within your plotting routine. If the vertical coordinate is greater than $BF, nothing is put to the screen. This cuts an object off if it leaves the screen.

To create wraparound, the vertical value is set to $00 when it passes $BF. Horizontal coordinates are treated in a similar manner. You can clip an image by stopping the display when the horizontal location exceeds $27, or create wraparound by allowing the values to cycle. If the horizontal position goes past $27, it becomes $00. If it goes below $00, it becomes $27. In essence, the line is treated in a MOD 27 fashion. We'll explore this in greater depth in later articles.

Listing 1.

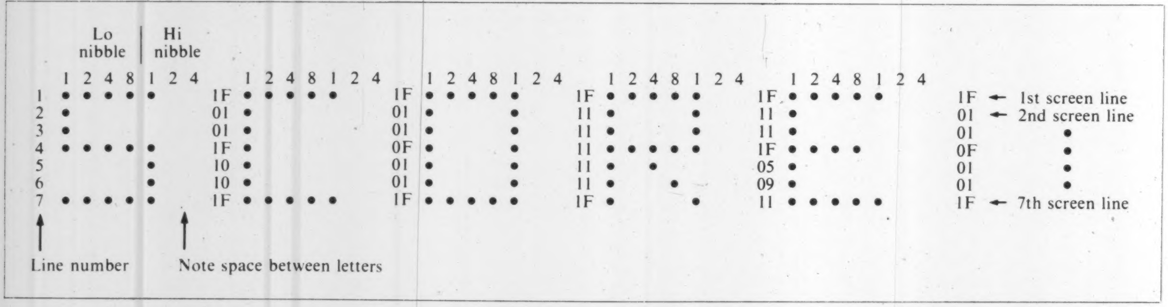
```
                         ORG  $1000
                * ROUTINE FOR PRINTING
                * MESSAGE BLOCKS.
                * USER MUST PASS DESIRED
                * COORDINATES.
                * LOOKUP TABLE MUST BE
                * APPENDED.
                * MESSAGE STARTS WITH TWO BYTES
                * GIVING HEIGHT AND WIDTH.
                *
                XLOC      EQU  $F8     ;PROVIDED BY USER
                YLOC      EQU  $F9     ;PROVIDED BY USER
                SRCLO     EQU  $FA
                SRCHI     EQU  $FB
                WIDTH     EQU  $FC
                HEIGHT    EQU  $FD
                XCOUNT    EQU  $FE
                TABLO     EQU  $1100   ;SEE LAST ISSUE
                TABHI     EQU  $11C0   ;FOR SCREEN TABLE
                *
                * FIND WIDTH AND HEIGHT
                * OF IMAGE
1000: AD 30 10            LDA  DATA
1003: 85 FC               STA  WIDTH
1005: AD 31 10            LDA  DATA+1
1008: 85 FD               STA  HEIGHT
100A: A2 00               LDX  #$00    ;X IS USED TO INDEX INTO IMAGE
                *
                * MAIN LOOP FOLLOWS
                *
100C: A4 F9     LOOP      LDY  YLOC    ;SET UP POINTER
100E: B9 00 11            LDA  TABLO,Y
1011: 85 FA               STA  SRCLO
1013: B9 C0 11            LDA  TABHI,Y
1016: 85 FB               STA  SRCHI
1018: A5 FC               LDA  WIDTH
101A: 85 FE               STA  XCOUNT
101C: A4 F8               LDY  XLOC    ;GET HORIZONTAL START
101E: BD 32 10  LINELOOP  LDA  DATA+2,X ;SKIP 1ST 2 BYTES
1021: 91 FA               STA  (SRCLO),Y ;PUT IT ON SCREEN
1023: E8                  INX          ;FOR NEXT BYTE OF IMAGE
1024: C8                  INY          ;NEXT HORIZONTAL LOCATION
1025: C6 FE               DEC  XCOUNT ;LINE DONE?
1027: D0 F5               BNE  LINELOOP ;NO
1029: E6 F9               INC  YLOC    ;GET READY FOR NEXT LINE
102B: C6 FD               DEC  HEIGHT ;IMAGE DONE
102D: D0 DD               BNE  LOOP    ;NO
102F: 60                  RTS          ;ALL DONE
                *
                * DATA FOR MESSAGE FOLLOWS
                * LISTED IN SEQUENTIAL ORDER.
                *
1030: 05 07     DATA      HEX  0507    ;WIDTH AND HEIGHT
1032: 3F 3F 3F            HEX  3F3F3F3F3F ;1ST LINE
1037: 01 01 21            HEX  0101212101
103C: 01 01 21            HEX  0101212101
1041: 3F 01 21            HEX  3F01213F1F
1046: 20 01 21            HEX  2001210901
104B: 20 01 21            HEX  2001211101
1050: 3F 3F 3F            HEX  3F3F3F213F

--- END ASSEMBLY ---

TOTAL ERRORS: 0

85 BYTES GENERATED THIS ASSEMBLY
```

Figure 1. Byte pattern for a message image.



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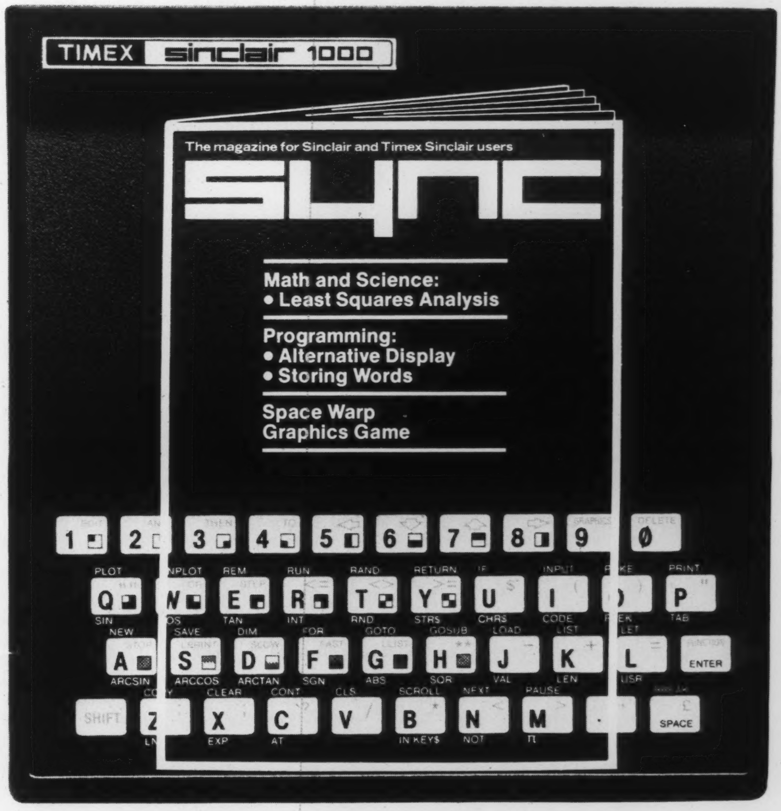
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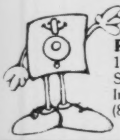

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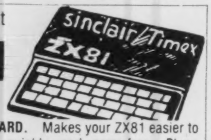

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Listing 2.

```
                        ORG  $1300
                 * SIMPLE CHARACTER GENERATOR
                 * USER MUST PASS COORDINATES
                 * AND DESIRED SHAPE NUMBER
                 *
                 XLOC      EQU  $F8    ;X COORDINATE
                 YLOC      EQU  $F9    ;Y COORDINATE
                 SHP       EQU  $FA     ;SHAPE NUMBER
                 YCOUNT    EQU  $FB
                 SRCLO     EQU  $FC
                 SRCHI     EQU  $FD
                 TABHI     EQU  $1100
                 TABLO     EQU  $11C0
                 CHRSET    EQU  $7000  ;START OF CHARACTER SET
                 *
                 * SET UP INDEX TO SHAPE
                 *
1300: A5 FA                LDA  SHP
1302: 0A                   ASL        ;MULTIPLY BY EIGHT
1303: 0A                   ASL
1304: 0A                   ASL
1305: AA                   TAX
1306: A9 08                LDA  #$08
1308: 85 FB                STA  YCOUNT
                 *
                 * PUT CHARACTER ON SCREEN
                 *
130A: A4 F9      LOOP      LDY  YLOC
130C: B9 C0 11             LDA  TABLO,Y
130F: 85 FC                STA  SRCLO
1311: B9 00 11             LDA  TABHI,Y
1314: 85 FD                STA  SRCHI
1316: A4 F8                LDY  XLOC
1318: BD 00 70             LDA  CHRSET,X ;GET BYTE OF DESIRED SHAPE
131B: 91 FC                STA  (SRCLO),Y ;PUT IT ON THE SCREEN
131D: E8                   INX
131E: E6 F9                INC  YLOC
1320: C6 FB                DEC  YCOUNT
1322: D0 E6                BNE  LOOP
1324: 60                   RTS
                 *
                 * PARTIAL CHARACTER SET
                 *
                           OBJ  $7000  ;FORCE TABLE INTO MEMORY
1325: 0E 11 11             HEX  0E11111111110E00 ;0
132D: 04 06 04             HEX  0406040404041F00 ;1
1335: 0F 10 10             HEX  0F10100804021F00 ;2
133D: 0F 10 10             HEX  0F10100E10100F00 ;3
1345: 09 09 09             HEX  0909091F08080800 ;4
134D: 1F 01 01             HEX  1F01010F10100F00 ;5
1355: 01 01 01             HEX  0101010F11110F00 ;6
135D: 1F 10 08             HEX  1F10080804040200 ;7
1365: 0E 11 11             HEX  0E11110E11110E00 ;8
136D: 1E 11 11             HEX  1E11111E10101000 ;9
1375: 04 0C 11             HEX  040C111F11111100 ;A
137D: 0F 11 11             HEX  0F11110F11110F00 ;B
1385: 1E 01 01             HEX  1E01010101011E00 ;C

--- END ASSEMBLY ---

TOTAL ERRORS: 0

104 BYTES GENERATED THIS ASSEMBLY
```

Character Sets

Getting back to the printing analogy, the fixed message blocks are fine for dedicated uses, but are inefficient for programs that contain many messages or have changing text. One example would be a score display. While the word SCORE can be saved as a block, the various score values cannot. It would be ridiculous to save 100 different images to display scores from 1 to 100.

Just as a linotype creates text from combinations of letters rather than stored words, we can put messages and scores on the screen using a character set. The character set contains all the desired letters and numbers, stored as byte images.

To use such a method, you must supply the routine with the desired coordinates and, additionally, information concerning which member of the set is to be displayed. This information is the shape number.

A set might start off with the digits from 0 to 9, followed by the letters of the alphabet. So the shape number for 0 would be 0, the number for A would be 10, B would be 11 and so on.

If your characters are one byte wide by eight bytes high, you can fit 32 characters into a single page of memory, and need be concerned only with the lo byte of the address of each character. These lo bytes can be either calculated or looked up from a table. In this example, where eight bytes are used for each character, the calculation is simple. Three ASL operations suffice to multiply a number by 8, thus providing the lo byte location.

A partial character display routine is given in Listing 2. I have defined the first few entries of the set, but haven't done the entire alphabet. To show how this routine might be used, Listing 3 contains a program that makes use of Listing 2. The program puts up a six-digit number and increments it.

This sort of program could be used for score keeping and other such functions.

Note the use of the 6502 BCD (Binary Coded Decimal) mode. I have found this to be the easiest method for keeping scores. The BCD mode treats each byte as two decimal digits, limiting each nibble to values from 0-9. Addition and subtraction are handled just as if the nibbles were decimal digits. But increment and decrement instructions still operate as if the digit were normal hex, so be careful.

If you add 01 to 009 in the BCD mode, the result will be 10, but an increment will produce 0A, which is not a valid BCD value. Also, be careful of branches when the decimal mode is set. It is best to clear the mode immediately after using it.

Listing 2 can be thought of as a dedicated routine. Each shape is the same size. But there is no need to restrict characters to one byte in width, nor is there any rule that says all characters must be the same size. Each character can be preceded by two bytes telling how wide and deep it is, allowing character sets with differing sizes. Also, larger characters allow for more creative use of color, a subject we'll look at now.

Colorforms

Small character fonts really can't make much use of color. Since there are only seven plotting bits in a byte, and since each letter should be bordered by blank bits on one side to prevent the text from blurring together, there isn't much room to produce both color and an appealing font.

As mentioned in previous articles, color is produced by plotting every second bit. This can't be done effectively in a small font. But it works out nicely in larger displays, as evidenced by the colorful large fonts found in many games.

If you create a large font and place

Listing 3.

```
                         ORG  $1000
                * SAMPLE PROGRAM THAT
                * USES CHARACTER SUBROUTINE
                *
                XSTART   EQU  $10
                DIGNUMB  EQU  $11
                DIG1     EQU  $12
                DIG2     EQU  $13
                DIG3     EQU  $14
                XLOC     EQU  $F8
                YLOC     EQU  $F9
                SHP      EQU  $FA
                TEMPLO   EQU  $FB
                TEMPHI   EQU  $FC
                DRAWCHAR EQU  $1300
                *
                * CLEAR SCREEN
                *
1000: A9 20              LDA  #$20
1002: 85 FC              STA  TEMPHI
1004: AA                 TAX
1005: A9 00              LDA  #$00
1007: 85 FB              STA  TEMPLO
1009: A8                 TAY
100A: 91 FB     CLRLOOP  STA  (TEMPLO),Y
100C: C8                 INY
100D: D0 FB              BNE  CLRLOOP
100F: E6 FC              INC  TEMPHI
1011: CA                 DEX
1012: 10 F6              BPL  CLRLOOP
1014: 8D 50 C0           STA  $C050
1017: 8D 52 C0           STA  $C052
101A: 8D 54 C0           STA  $C054
101D: 8D 57 C0           STA  $C057
1020: 85 12              STA  DIG1    ;INITIALIZE SCORE TO 0
1022: 85 13              STA  DIG2
1024: 85 14              STA  DIG3
                *
                * LOOP TO INCREASE AND DISPLAY SCORE
                *
                * GET DIGITS STARTING WITH HIGHEST
                *
1026: A9 02     MAINLOOP LDA  #$02
1028: 85 11              STA  DIGNUMB
102A: A9 11              LDA  #$11
102C: 85 10              STA  XSTART
102E: A6 11     DIGLOOP  LDX  DIGNUMB
1030: B5 12              LDA  DIG1,X
1032: 4A                 LSR          ;SHIFT DOWN HI NIBBLE
1033: 4A                 LSR
1034: 4A                 LSR
1035: 4A                 LSR
1036: 85 FA              STA  SHP
1038: A5 10              LDA  XSTART
103A: 85 F8              STA  XLOC
103C: A9 00              LDA  #$00
103E: 85 F9              STA  YLOC
1040: 20 00 13           JSR  DRAWCHAR
1043: E6 10              INC  XSTART ;MOVE TO NEXT POSITION
1045: A6 11              LDX  DIGNUMB
1047: B5 12              LDA  DIG1,X
1049: 29 0F              AND  #$0F   ;GET LO NIBBLE
104B: 85 FA              STA  SHP
104D: A5 10              LDA  XSTART
104F: 85 F8              STA  XLOC
1051: A9 00              LDA  #$00
1053: 85 F9              STA  YLOC
1055: 20 00 13           JSR  DRAWCHAR
1058: E6 10              INC  XSTART
105A: C6 11              DEC  DIGNUMB
105C: 10 D0              BPL  DIGLOOP
                *
                * INCREASE SCORE
                *
105E: F8                 SED          ;USE BCD MODE
105F: A5 12              LDA  DIG1
1061: 18                 CLC
1062: 69 01              ADC  #$01
1064: 85 12              STA  DIG1
1066: A5 13              LDA  DIG2
1068: 69 00              ADC  #$00
106A: 85 13              STA  DIG2
106C: A5 14              LDA  DIG3
106E: 69 00              ADC  #$00
1070: 85 14              STA  DIG3
1072: D8                 CLD          ;DECIMAL MODE MUST BE CLEARED
1073: AD 00 C0           LDA  $C000  ;CHECK FOR KEYPRESS
1076: 10 AE              BPL  MAINLOOP
1078: 2C 10 C0           BIT  $C010
107B: 60                 RTS
```

it on the screen, you may find that the letters alternate in color, since an image started on an odd byte will be a different color than the same pattern started on an even byte. There are several ways around this problem.

One fairly painless but limiting solution is to make each image an even number of bytes wide. Thus, if a message is started on an odd byte, each succeeding letters will also start on an odd byte. Figure 2 shows an image for a letter that is two bytes wide and a single color. Note how the hi bit is skipped and how the set bits are designed to maintain color.

Other methods of dealing with color involve color masks and shifting. A color mask is simply a byte pattern that turns off undesired bits. The first step would be to create a white image by setting sequential bits in the shape.

Now suppose you want only the odd bits to be set. You would make two masks, one with only even bits set ($2A), the other with odd bits set ($55 ignoring the hi bit).

Now, when a byte is placed on an even byte, it is ANDed with the even mask value $2A. This turns off all the bits occuring on even locations. When the byte is to be placed on an odd position, it is ANDed with the $55 mask. As a result, only bits occurring on odd positions will be displayed (see Figure 3).

Fortunately, it is very easy to determine whether a coordinate is odd or even. Just take the horizontal value and perform the LSR operation. If the carry is set, the number is odd.

Rotation can be used to change or control the color of an image. Let's say you have a character set defined with internal color by skipping every other bit. As mentioned, it will have one color when a character is started on odd bytes, and another color when started on even bytes.

But suppose you want to maintain color. The solution is to rotate each byte before putting it on the screen. Assume the color you desire is the one produced when the byte starts at an odd location. To produce the same color on even locations, each byte is rotated before being placed on the screen.

The problem with this method is that bits that rotate out of one byte must be placed in the next byte. If all eight bits of a byte were used for plotting, this would be a simple operation, since the carry would pass on such bits, but the hi bit of the Apple gets in the way, complicating the process. In general, the masking method is quicker and simpler.

One other alternative, when space is

Listing 4.

```
                         ORG  $1000
                 * PROGRAM TO SCROLL THE
                 * SCREEN VERTICALLY.
                 * USES A LOOKUP TABLE.
                 *
                 SRCLO   EQU  $F8
                 SRCHI   EQU  $F9
                 DESTLO  EQU  $FA
                 DESTHI  EQU  $FB
                 LINE    EQU  $FC
                 TABHI   EQU  $1100
                 TABLO   EQU  $11C0
                 *
1000: 8D 50 C0           STA  $C050
1003: 8D 52 C0           STA  $C052
1006: 8D 54 C0           STA  $C054
1009: 8D 57 C0           STA  $C057
100C: A2 BF      SCROLL  LDX  #$BF
100E: BD C0 11   LOOP1   LDA  TABLO,X
1011: 85 FA              STA  DESTLO
1013: BD 00 11           LDA  TABHI,X
1016: 85 FB              STA  DESTHI
1018: CA                 DEX
1019: BD C0 11           LDA  TABLO,X
101C: 85 F8              STA  SRCLO
101E: BD 00 11           LDA  TABHI,X
1021: 85 F9              STA  SRCHI
1023: A0 27              LDY  #$27    ;40 BYTES PER LINE
1025: B1 F8      LOOP2   LDA  (SRCLO),Y
1027: 91 FA              STA  (DESTLO),Y
1029: 88                 DEY
102A: 10 F9              BPL  LOOP2
102C: E0 00              CPX  #$00
102E: D0 DE              BNE  LOOP1
                 *
                 * SCROLL DONE. NOW HAVE TO
                 * BLANK OUT TOP LINE.
                 *
1030: A9 00              LDA  #$00
1032: A0 27              LDY  #$27
1034: 91 F8      LOOP3   STA  (SRCLO),Y ;STILL POINTING TO TOP LINE
1036: 88                 DEY
1037: 10 FB              BPL  LOOP3
                 *
                 * CHECK FOR KEYPRESS
                 *
1039: AD 00 C0           LDA  $C000
103C: 10 CE              BPL  SCROLL
103E: 2C 10 C0           BIT  $C010
1041: 60                 RTS

--- END ASSEMBLY ---

TOTAL ERRORS: 0

66 BYTES GENERATED THIS ASSEMBLY
```

Figure 2. 2 byte wide colored letter. Note use of alternating (circled) bits.

	1st byte							2nd byte							
	①	2	④	8	①	2	④	1	②	4	⑧	1	②	4	
50					●		●		●						02
14			●		●				●		●				0A
05	●		●								●		●		28
55	●		●		●		●		●		●		●		2A
55	●		●		●		●		●		●		●		2A
05	●		●								●		●		28
05	●		●								●		●		28

Figure 3. Bit masks for displaying odd bits.

		byte 0							byte 1							
Horizontal position		0	1	2	3	4	5	6	7	8	9	10	11	12	13	
Bit valve		1	2	4	8	1	2	4	1	2	4	8	1	2	4	
Bit mask	2A —		●		●		●		●		●		●		●	— 55

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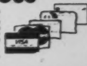

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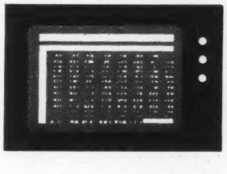

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Graph Paper, continued...

no problem, would be to have two separate fonts — one with the odd bits set, the other with even bits set. In general, this approach isn't worth the space.

I am indebted to Ernie Brock, author of *Pascal Graphics Editor*, for providing me with a wealth of information on character graphics and color control.

Ups and Downs

Scrolling is just a specialized form of byte manipulation. To make the screen scroll down, the bytes in the next to last line are moved to the last line, the bytes from the third from last line are moved to the next to last line, and so on. If required, new data is brought in to fill the vacated top line.

A downward scroll must start at the bottom and work up. If the procedure started at the top, the result would be duplication of the top line all the way down. First, the top line would be moved to the second line, then the second line (which contains the same values as the top line) would be moved to the third line, and so on.

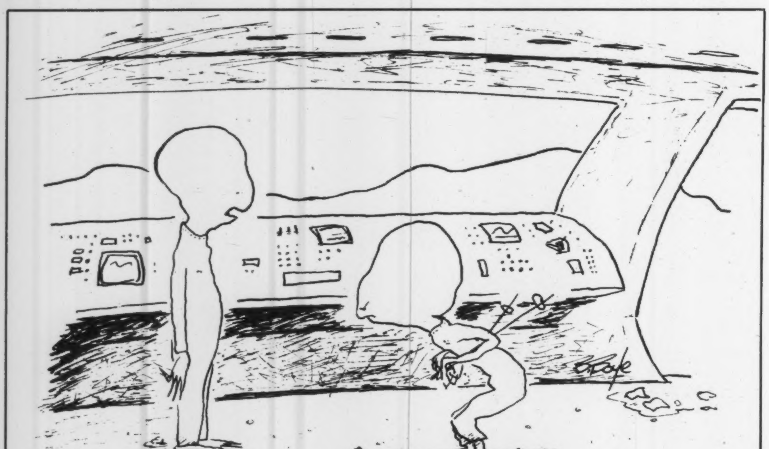
To demonstrate the process, Listing 4 contains a short program that scrolls the whole screen downward. After each move, the top line is replaced with $00, so the end result is a blank screen. To scroll horizontally, the same basic technique is used, but rather than move each line up or down, each byte within a line is moved over.

Listing 5.

```
:ASM
                  1                ORG  $1000
                  2     SRCLO      EQU  $F8
                  3     SRCHI      EQU  $F9
                  4     TABHI      EQU  $1100
                  5     TABLO      EQU  $11C0
                  6     * HORIZONTAL SCROLLING
                  7     *
1000: 8D 50 C0 8                   STA  $C050
1003: 8D 52 C0 9                   STA  $C052
1006: 8D 54 C0 10                  STA  $C054
1009: 8D 57 C0 11                  STA  $C057
100C: A2 00       12    SCROLL     LDX  #$00    ;192 LINES
100E: BD C0 11 13       LOOP1      LDA  TABLO,X
1011: 85 F8       14               STA  SRCLO
1013: BD 00 11 15                  LDA  TABHI,X
1016: 85 F9       16               STA  SRCHI
1018: A0 27       17               LDY  #$27
101A: B1 F8       18               LDA  (SRCLO),Y ;SAVE END OF LINE
101C: 48          19               PHA
101D: 88          20    LOOP2      DEY
101E: B1 F8       21               LDA  (SRCLO),Y
1020: C8          22               INY
1021: 91 F8       23               STA  (SRCLO),Y
1023: 88          24               DEY
1024: D0 F7       25               BNE  LOOP2
1026: 68          26               PLA          ;RESTORE END BYTE
1027: 91 F8       27               STA  (SRCLO),Y
1029: E8          28               INX
102A: E0 C0       29               CPX  #$C0
102C: D0 E0       30               BNE  LOOP1
102E: AD 00 C0 31                  LDA  $C000
1031: 10 D9       32               BPL  SCROLL
1033: 2C 10 C0 33                  BIT  $C010
1036: 60          34               RTS

--- END ASSEMBLY ---

TOTAL ERRORS: 0

55 BYTES GENERATED THIS ASSEMBLY
```

Because of the odd/even color problem on the Apple, a scroll of one byte will produce an image that alternates between colors with each move.

Listing 5 shows a program that scrolls the screen horizontally. In this case, the byte that moves off the edge is replaced on the other side. Note that execution time could be improved by using separate source and destination pointers rather than manipulating the register so much.



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In many cases, you won't want to scroll the whole screen. Many games have a small area scrolling across the bottom. In such cases, where the scene being scrolled is larger than the screen, an image of the area is kept elsewhere in memory. For each screen line, there is a data line containing the full landscape image for that screen line. In this way, a varying landscape can be scrolled across the screen. A variable is kept pointing to the portion of the data which is currently the start of a screen line. To scroll the image, the pointer is changed, and the bytes for each line are taken from the data and put to the screen.

You may have noticed that the full-screen scroll is not very fast. When speed is required, there is another method available, using dedicated code. Rather than use indirect indexing, this method contains a sequence that specifies each memory location in the scrolling sequence. The advantage of such a method is high speed. The problem is that the code is

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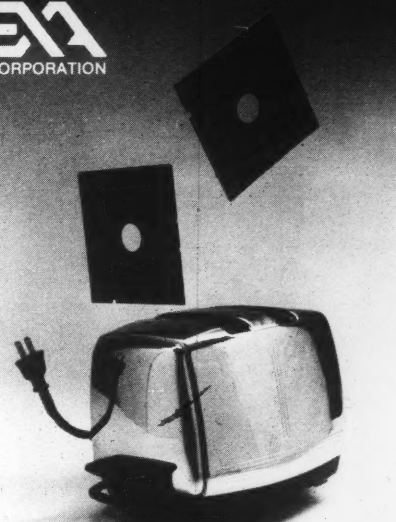

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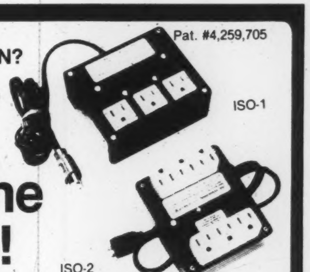

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rather long. For a full screen, the code would contain 192 loads and 192 stores. A segment of such a routine is shown in Listing 6. In general, this type of dedicated code should be used whenever speed is essential.

Code of Many Colors

We have already seen how the six basic colors are obtained on the Apple. Alternating dots produce color, sequential dots produce white, and an absense of dots results in black. But many other colors can be produced on the Apple by combining colors.

For instance, suppose you turn on every fourth pixel of a line. If you repeate the process on the next line, the result would be alternating colored and black vertical stripes. This, however, is not an interesting blend.

But suppose the lines were staggered. The first line starts on bit 0 and sets every fourth pixel. The next line starts with bit 2 and again sets every fourth pixel. The third line begins at 0, the fourth line at 2 and so on. Now, the colors blend to produce a darker shade of the original color.

This is the general method for obtaining those "extra" colors. Such patterns can be stored as a series of bytes, then be moved to the screen, or be ANDed with the screen, to produce colorful effects.

For instance, the pattern described above would be $11, $22, $44, $08, repeated to fill the first line. Then, for the second line, the sequence would be $44, $08, $11, $22, etc. If you want to fill an area, you just store the bytes to the screen. If you want to color an object, you AND it with the color bytes.

That's all about that will fit this month. Next time, we'll get into full animation with pre-shifted shapes. We'll cover the various methods being used in arcade games. ☐

Listing 6.

```
:ASM
                 * SAMPLE PORTION OF
                 * A DEDICATED SCROLLING
                 * ROUTINE
                 *
7000: A0 27      START     LDY   #$27    ;40 BYTES PER LINE
7002: B9 00 24   LOOP      LDA   $2400,Y ;2ND LINE
7005: 99 00 20             STA   $2000,Y ;1ST LINE
7008: B9 00 28             LDA   $2800,Y ;3RD LINE
700B: 99 00 24             STA   $2400,Y ;2ND LINE
                 *
                 * THIS CONTINUES FOR 192 LOADS
                 * AND STORES.
                 *
                 *
700E: 88                   DEY
700F: 30 03                BMI   DONE
7011: 4C 02 70             JMP   LOOP
7014: 60         DONE      RTS

--- END ASSEMBLY ---

TOTAL ERRORS: 0

21 BYTES GENERATED THIS ASSEMBLY
```

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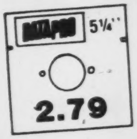

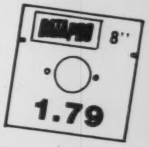

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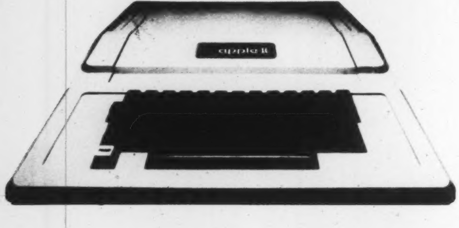


e cart...apple cart...apple

Michael Coffey

Earlier this year, we received many letters because a game program we published contained a bug. The problem involved an incorrect method of reading the Apple II keyboard. Most of the letters contained incorrect fixes for the bug. Maybe we should take a look at the problem.

We want to write a program that does not hang around waiting for keyboard input but that uses keyboard input whenever it becomes available. The Apple can tell us whether or not a key has been pressed recently if we cooperate.

One memory location is set aside to hold the last key pressed. Another is reserved for the program to tell the hardware that the last key has been read. The first location is also used by the hardware to tell the programmer that there is a new key to read.

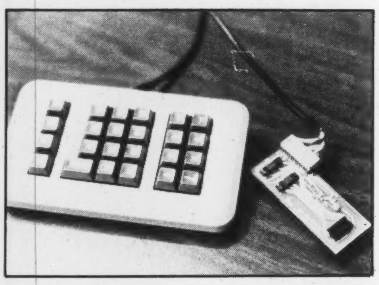
Our strategy is to read that first location frequently to see if a new key has been pressed. When a new key is ready, we must do two things: save the key value in another location and tell the hardware that we have read the key.

In Basic, we use the PEEK function to learn whether a key is available. If the value of PEEK(−16384) is greater than 127, a key has been pressed. We will use the variable KD, short for key data, to denote this address.

When a key is ready, the function PEEK(−16384) yields the ASCII code for the key. The CHR$ function turns an ASCII code into a single-character string. We will assign the character string to the variable K$.

Once we have determined K$, we must clear the keyboard so that more keystrokes can be recorded. We POKE a value into location −16368 — any value. We use KC to stand for the address used for keyboard clearance.

Listing 1 is a program that reads the keyboard and maintains a special cursor on the screen. The program will keep the latest character in K$, call subroutine 2000 whenever a key is pressed, and call subroutine 3000 on each loop where no key is pressed.



Numeric Keypad.

Subroutine 2000 simply displays the new value of K$. Subroutine 3000 displays an underline cursor and backs up one space. If you remove the backspace function (CHR$(8)), you will get an idea of how many times the loop runs between keypresses.

The program works for all literal keys, but some control keys can make the screen look strange. The main loop is a good starting point for any keyboard processing program. The subroutines should be adapted for your specific purposes.

Incidentally, the technique of repeatedly checking a keyboard or other input device is called polling. You now know how to do polled keyboard input. Congratulations.

Repeaterrr

Speaking of keys, we recently received a small board that converts an Apple keyboard into one with automatic repeat on all the keys except Reset. The Repeaterrr, though hard to spell, is easy to use.

When you hold down a key, it will repeat itself to the Apple. You can adjust the length of time the key waits before repeating. If you make the period very short, you will end up with keybounce. If you make it very long, guest typists will never notice your modification. We like to make it just long enough to avoid accidental repeats.

Besides the autorepeat feature, you get a fast repeat feature. Just press the repeat key and the key will repeat itself much faster than usual. Your software will hardly be able to keep up with the keyboard in fast repeat mode.

The board must be sandwiched between the keyboard and the keyboard encoder board. Consequently the bottom of the computer must be unscrewed and removed. Apples with old style keyboards can not use this modification.

The Repeaterrr comes with very explicit instructions and is a good buy at $24.95.

Numeric Keypad

This hardware add-on is dedicated to VisiCalc users everywhere. Anyone else who types many numbers can key along. Numbers and related symbols can be produced with the keypad from The Keyboard Company.

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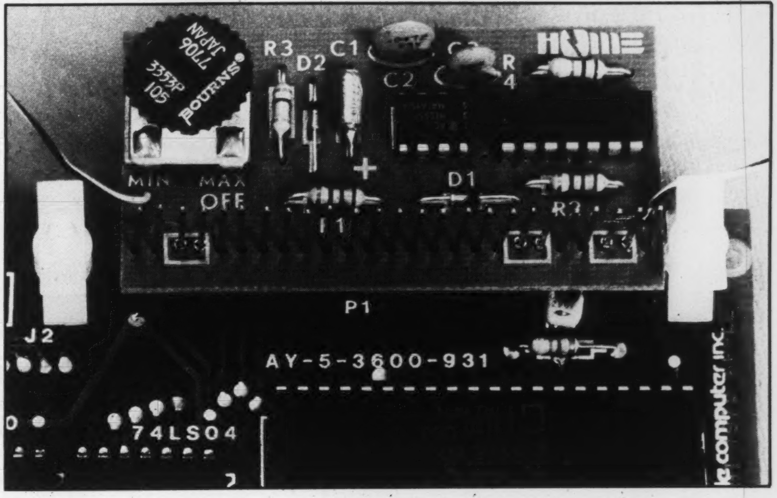
CIRCLE 202 ON READER SERVICE CARD

Apple Cart, continued...



Repeaterrr.

The keypad is easy to install if you don't mind pulling the computer apart. First, you must remove the bottom plate of the Apple, carefully unplugging the standard keyboard. Next, plug the new keypad into the motherboard and plug the standard keyboard connector into a new circuit board that comes with the numeric keypad. Replace the bottom plate and you are ready to compute again.

The 5′ cable should be threaded through one of the slots in the back of the Apple. A molded fitting on the cable prevents it from being yanked out of the computer by accident. The unit measures 8.25″ × 5″ × 1.5″ and weighs only a few ounces.

The Numeric Keypad provides a slightly more distinct feedback than the standard keyboard, has bumps on two of the keys to aid in positioning your fingers, and is otherwise similar to the Apple keyboard.

The 24 keys are arranged in three groups. The central group includes the digits 0-9, the decimal point, and a 00 key. To the left of the digits is a group of VisiCalc editing keys including ESC, both arrows, and a space bar equivalent.

To the right of the digits The Keyboard Company has mounted a return key, both parentheses, and the numeric operations −, /, +, and *. The last key on the lower right is labeled PRINT and produces a question mark when pressed. See Figure 1 for a more precise layout of the keys.

As far as we can tell, the keypad interferes in no way with the operation of any Apple II software. The advantages are obvious and well worth the price to anyone who spends more than a few hours a week typing numbers.

Magic Keyboard

One of the wildest keyboard modifications we have seen comes from Southern California Research Group. Magic Keyboard enables you to rearrange the keys on your keyboard. If you want to study keyboard layout technology and psychology, this one is for you.

This 2.5″ × 3″ board must be planted in the keyboard socket on the Apple motherboard. The cable from the keyboard can then be plugged into the Magic board. This means that you have to remove the bottom plate from your Apple again.

Before putting things back together, you must make a few choices. You can choose an alternate alphabetic layout and a numeric layout. The instructions detail the available options. Dvorak standard, left hand only, right hand only, and other layouts are all built in.

After installing, you will be able to shift between regular QWERTY layout and the preselected alternate layout with the flick of a switch. The press of a button will shift you between the alphabetic and numeric layouts. The switch and the button are both mounted on a little pad that can be stuck to the Apple or any other convenient surface.

We tried the Dvorak layout and found that we did not have enough time to learn it. As workers that are forced to use many different keyboards, we can't see any payoff for us in learning a new one at the moment. I encourage layout experimentation and hope for the day when all keyboards are programmable. □

Listing 1.

```
100 KC = -16368
110 KD = -16384
120 K$ = ""

1000 IF PEEK(KD) > 127 THEN K$ =
      CHR$( PEEK(KD) ): POKE KC,0:
      GOSUB 2000: GOTO 1100
1010 GOSUB 3000
1100 REM COME FROM 1000
1110 GOTO 1000

2000 PRINT K$;: RETURN
3000 PRINT CHR$(223); CHR$(8);:
      RETURN
```

Firms Mentioned in this Column

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17 River St.
Chagrin Falls, OH 44022
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The Keyboard Company
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Garden Grove, CA 92641
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Southern California Research Group
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"Oh yeah, my calculator can out-calculate your calculator."

outpost: atari

John Anderson

The Upstart Atari

June 4, 1981, *The New York Times* ran a relatively enlightened feature on the microcomputer and its future in the home. One of the "experts" cited in the feature stated the following: "there is almost no sense at all in buying a computer other than a PET, Radio Shack, or Apple." A bit further down the page, in a separate but allied article, the quote appeared *again,* this second time without the word "almost." The article referred to these companies as "the big three."

At the time, I was glad to see that the *Times* had discovered microcomputers, but was chagrined by what I saw as expert narrowmindedness. Still, it came as no surprise to me. I had acquired quite a stiff upper lip by that time. You see, I am an Atari owner.

I remember when I first began shopping seriously for a micro, right about the time the first Ataris were shipped. I had a great deal of trouble getting anyone to talk about the machine. Sales staff seemed so resentful in one computer store, I wondered aloud why they even carried the thing. A salesperson exclaimed to me, through a sneer, that he did not expect it would be carried for long.

Even as recently as a year and a half ago, finding an article concerning the Atari in a computer magazine was a triumph. The machines remained a mystery, even to those who owned them. Documentation and software were scant. I was told by more than one learned microguru that I had made an expensive error. They predicted nothing but early death.

This was not to be. Despite the bad press and initial lack of documentation and software, the Atari was gradually discovered to be a superior machine: a "next-generation" micro, with ROM cartridge capability, a replaceable operating system, sophisticated color graphics capability, and four-channel sound.

Despite initial snobbery and snubbery, buyers began to opt for a good machine at a good price. By Christmas 1981, the Atari was being sold faster than it could be manufactured.

How did the competition respond to the introduction of the Atari? With the introduction of Atari lookalikes. Studying these, I realized Atari must have done something right, to have nearly everybody else shouting "me too!" within a year or so.

The Atari has been called a game machine, and games have certainly sold their share of units. Ted Nelson took a look at *Star Raiders* on a video projection system and proclaimed that the Atari Personal Computer was the "most extraordinary (microcomputer) graphics box ever made." Yet in addition, the Atari could do anything the "big three" could do, and then some. Many prospective purchasers found in the Atari a double bonus: a chance to have a "serious" microcomputer, while owning the greatest game machine around.

And, it was friendly. It is easier to do things right on the Atari, and more importantly, harder to do things wrong. The jargon terms machines like this "user-friendly." Never before had a computer been introduced that was so easy to use. Until the Atari came along, you couldn't expect to take a micro out of its box, plug it in, and have it work.

In the operating system of the machine is a powerful, built-in screen editor, which makes the mechanics of programming much less formidable on the Atari than on other machines. I know for a fact that this, combined with the syntax-checking function of Atari Basic, allowed me to learn Basic programming at a much faster pace than would have been possible with any other microcomputer. These features simply allow the user to recover more gracefully from his own errors, thus vastly increasing the utility of the machine as a learning tool.

Then there is the cost. I literally "paid the price" to be the first on the block with an Atari 800. Now, because of the popularity of the machine, prices have dropped dramatically. A bit of careful shopping can result in a basic unit for under $700. For this price, you receive an 800 with 16K of RAM and Atari Basic. The model 400 is down to about $250.

The computers have a built-in RF modulator, and so can be hooked directly to a home TV. A basic unit isn't worth much without cassette or disk storage devices, which constitute an additional expense, however the Atari disk drive has also been heavily discounted, and can be found for under $450. A 48K disk-based system can be put together for under $1400, and that is a good bargain at today's (and tomorrow's) prices.

As for the capabilities of such a system, let me first insert here a warning to those who may be unfamiliar with the moiling and sweaty world of microchauvinism. I feel strongly, as do other Atari owners, that a major part of what a microcomputer must handle superlatively is color graphics and sound. I take this to be a self-evident, foregone and unimpeachable tenet, and will make no effort to argue for or defend myself upon that point. If you do not concur, read on only at your own risk.

The 6502 microprocessor chip is the central processing unit of all current Atari machines, as it is for two of the "big three" machines. However in the

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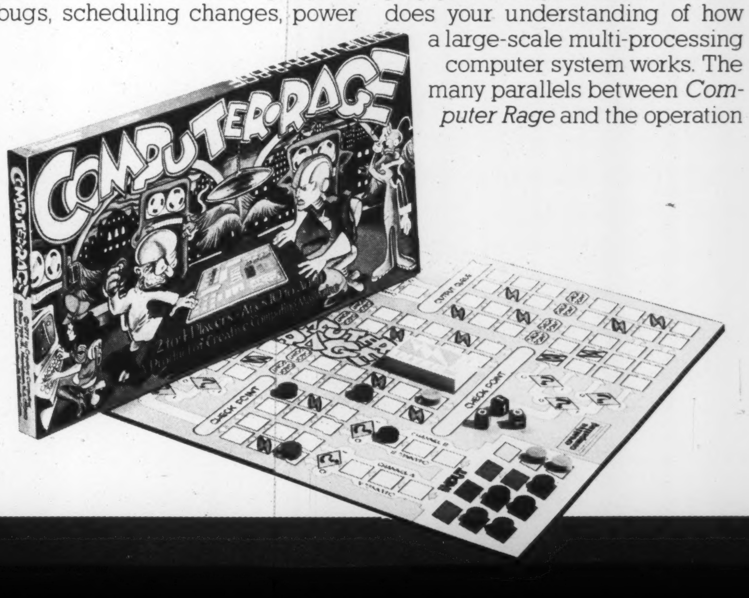

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```
10000 MT=PEEK(106)
10010 GT=MT-8
10020 POKE 106,GT
10030 GRAPHICS 0
10040 SETCOLOR 2,0,0
10050 CROM=PEEK(756)*256
10060 CRAM=GT*256
10070 POKE 756,GT
10080 ? "character set LOADING"
10090 FOR N=0 TO 1023
10100 POKE CRAM+N,PEEK(CROM+N)
10110 NEXT N
10120 FOR N=264 TO 471:READ A:POKE CRAM+N,A:NEXT N
10130 FOR N=776 TO 983:READ A:POKE CRAM+N,A:NEXT N
10140 ? :? "CHARACTER SET loaded":END
10150 DATA 32,168,136,136,168,136,136,0,160,136,136,160,136,136,160,0,168,136,12
8,128,128,136,168,0
10160 DATA 160,136,136,136,136,136,160,0,168,128,128,168,128,128,168,0,168,128,1
28,168,128,128,128,0
10170 DATA 168,136,128,138,136,136,168,0,136,136,136,168,136,136,136,0,168,32,32
,32,32,32,168,0
10180 DATA 8,8,8,8,136,136,168,0,136,136,136,160,136,136,136,0,128,128,128,128,1
28,128,168,0
10190 DATA 136,168,168,136,136,136,136,0,136,136,168,168,168,168,136,0,168,136,1
36,136,136,136,168,0
10200 DATA 160,136,136,160,128,128,128,0,168,136,136,136,136,136,168,10,160,136,
136,160,136,136,136,0
10210 DATA 168,136,128,168,8,136,168,0,168,32,32,32,32,32,32,0,136,136,136,136,1
36,136,168,0
10220 DATA 136,136,136,136,136,136,32,0,136,136,136,136,168,168,136,0,136,136,13
6,32,32,136,136,0
10230 DATA 136,136,136,32,32,32,32,0,168,8,8,32,128,128,168,0
10240 DATA 16,84,68,68,84,68,68,0,80,68,68,80,68,68,80,0,84,68,64,64,64,68,84,0
10250 DATA 80,68,68,68,68,68,80,0,84,64,64,84,64,64,84,0,84,64,64,84,64,64,64,0
10260 DATA 84,68,64,69,68,68,84,0,68,68,68,84,68,68,68,0,84,16,16,16,16,16,84,0
10270 DATA 4,4,4,4,68,68,84,0,68,68,68,80,68,68,68,0,64,64,64,64,64,64,84,0
10280 DATA 68,84,84,68,68,68,68,0,68,68,84,84,84,84,68,0,84,68,68,68,68,68,84,0
10290 DATA 80,68,68,80,64,64,64,0,84,68,68,68,68,68,84,5,80,68,68,80,68,68,68,0
10300 DATA 84,68,64,84,4,68,84,0,84,16,16,16,16,16,16,0,68,68,68,68,68,68,84,0
10310 DATA 68,68,68,68,68,68,16,0,68,68,68,68,84,84,68,0,68,68,68,16,16,68,68,0
10320 DATA 68,68,68,16,16,16,16,0,84,4,4,16,64,64,84,0
```

Figure 1.

Atari, the 6502 chip is backed up by three others, and therein lies a big difference.

One of these chips, called Antic, is itself a microprocessor. It is capable of an exotic potential known as "direct memory access," or DMA. Antic works in tandem with another chip, the GTIA or CTIA, to handle the video display, thus taking the weight of keeping the video screen "lit up" from the 6502. The CPU can go on to other important jobs.

I could attempt to outline each of the capabilities of these chips: 256 colors, up to 16 shades of a single color, 320 x 192 pixel resolution, player-missile graphics, modifiable display lists and character sets. However there really are only two ways to experience their power: watch an Atari graphics demo, or play a quality Atari game. The new GTIA chip, which replaces the CTIA, extends this power yet further.

Still another chip, called Pokey, generates, among other things, four channel sound. This sound can range from pure tone to many levels of distortion, allowing for music as well as sophisticated and complex sound effects generation. Sound is routed through the TV speaker, and so volume control is as simple as the flick of a knob. Sound can be routed just as simply to your stereo. Nearly all music composition and game playing in my home takes place through headphones.

The Atari is not without its problems. Much of the software written for it doesn't come close to truly utilizing its capabilities. It seems as if many programmers are having trouble realizing what power the Atari puts in their hands, and how best to use it. Dual density drives, 80-column capability, and truly professional word processing packages are only just now making an appearance.

But relief is in sight. It was a trickle at first, but third party software began to pour in. The trickle became a gush, and the gush became a torrent. Third party hardware followed soon after. The industry, realizing its initial underestimation of the machine, is compensating.

A variety of talented minds are working with the Atari, investing it with a variety of new capabilities. The machine offers one of the most exciting forefronts in the microcomputer industry today.

Incidentally, the big three will shortly have to move over. I predict by the end of this year Atari will be the number one microcomputer in its class, both in monthly sales and total units.

"This really is a friendly system, J.B.!"

Multicolor Characters

Figure 1 is a short program with a very neat result: a multicolor character set in graphics 0. The idea goes back quite a ways: I remember first having seen it in *3-D Supergraphics,* from Paul Lutus. A recent example appears in the assembly language tutorial *Page Six,* from Synapse Software, which uses quite a well done font.

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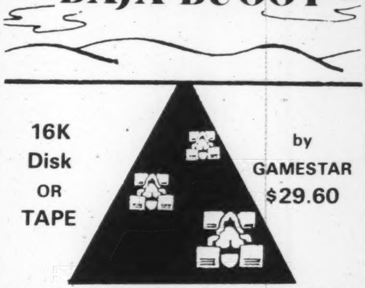

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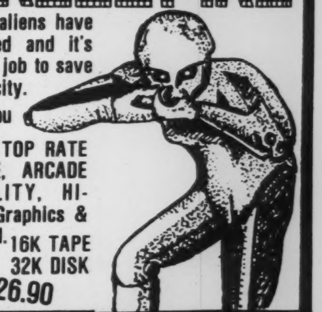

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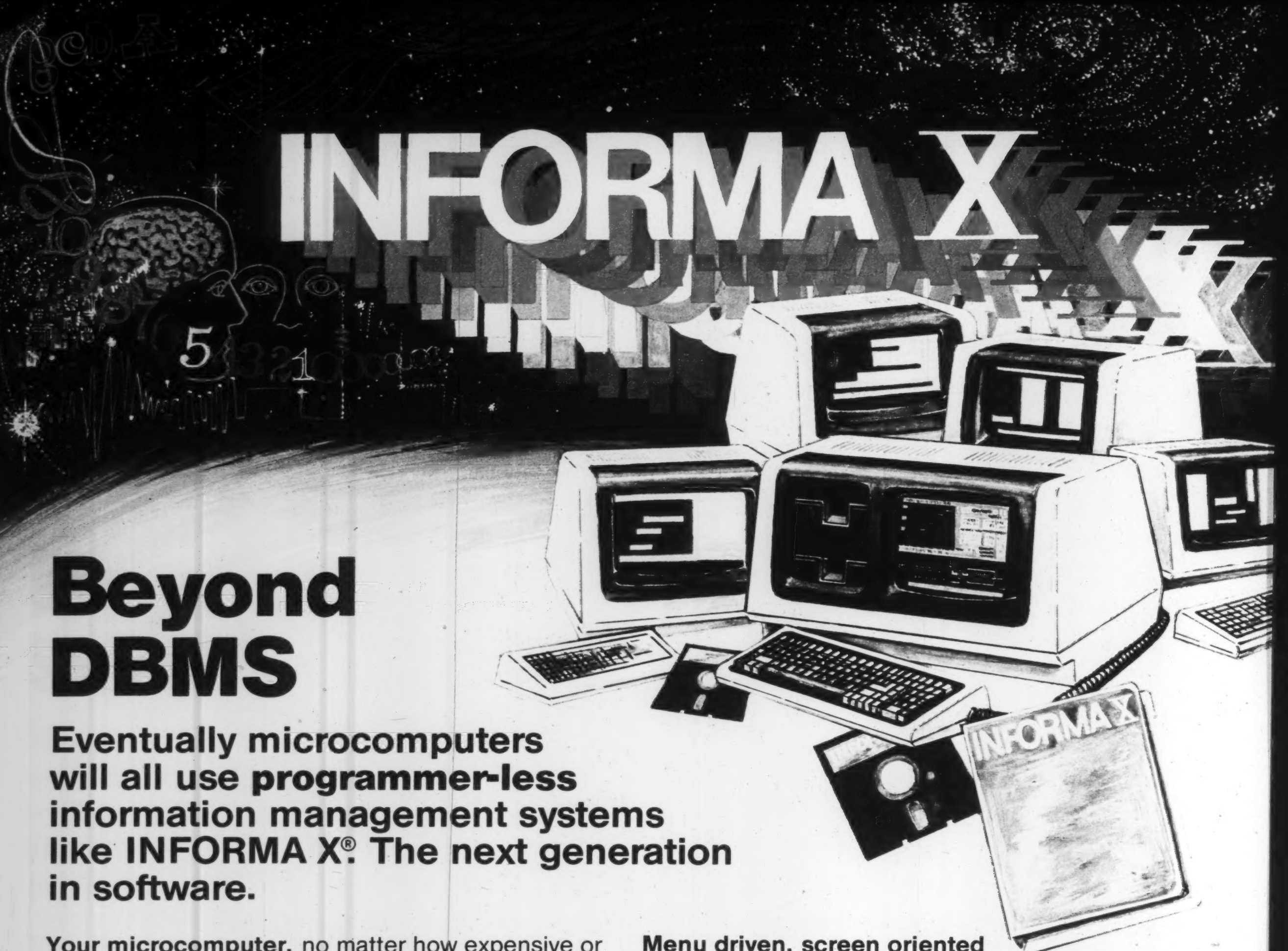

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Outpost: Atari, continued...

The technique involved in creating multicolor characters is called artifacting. This is the same phenomenon that sometimes causes ugly glitches in graphics 8 displays. By skipping adjacent pixels, red or blue characters can be formed, and artifacting can be used constructively.

The approach has its limitations. Because the default character size on the Atari is 8 x 8, skipping adjacent pixels results in a character three pixels wide. It is hard to create a font three pixels wide and at the same time keep N's and M's from looking alike, or support lower case.

In order to compensate, I made the font one scan line taller than the default value, and stuck to upper case. Still, I think you will agree the results are remarkable considering the constraints of the approach, and well worth taking the time to type.

Lines 10000 through 10020 define the point in memory at which we will start our redesigned character set. Lines 10030 and 10040 clear the screen, coloring it black, so that the artifacted character set will be clear. I suggest the altered set always be used on a black background.

Lines 10050 and 10060 set up the variables we will use to load the original character set into RAM, and later for overwriting the redefined characters. Line 10070 sets the character set pointer to the beginning of the RAM set. Line 10080 is placed there so you can watch the transformation take place; you can pull this line if you so desire.

Lines 10090 through 10110 load the entire original ROM character set into RAM. Then line 10120 replaces the upper case A through Z with values occurring up ahead as data statements. Likewise line 10130 replaces lower case a through z with newly defined character values.

The new upper case and lower case fonts are the same, with the exception of a one clock horizontal shift. This means that the upper case A through Z will be one color, and the lower a through z another. Because of differences in the way artifacting is handled by the GTIA as opposed to the CTIA, a GTIA machine will have, as a result of running this program, a blue upper case and red lower case, while a CTIA machine will have a red upper case and blue lower case. Not to mention what happens when printing inverse characters. Try it! All other characters, as well as numbers, will remain as default.

```
10 ? "FLASHING TEXT":REM PRECEDING TEXT IN INVERSE
20 POKE 755,1
30 FOR N=1 TO 100:NEXT N
40 POKE 755,2
50 FOR N=1 TO 100:NEXT N
60 GOTO 20
```

Figure 2.

You might now incorporate this as a subroutine in other Basic programs (remember to stick a RETURN in there somewhere, and keep the program from hitting line 10000 other than through that initial GOSUB).

Sheldon Leemon, on whose program, *Instedit,* I designed the font, reminded me that the display list could be modified to display the fonts in any color. I may take up this challenge in a subsequent Outpost. For now, I will leave it to you. List the program in the modified set; you will see that it can even function as a programming tool.

Poking Around

As a result of my comments about memory locations in the November column, I got a slightly indignant letter from Becky Johnson, at Educational Software (formally Santa Cruz Educational Software). She reminded me that their publication *Master Memory Map* had sold more than 10,000 copies at $6.95. Well I admit I hadn't seen the publication at the time, and though it is still not a truly *definitive* list, it has got to be the closest yet. If you wish more information, you can contact them at 4564 Cherryvale Ave., Soquel, CA 95073. (408) 476-4901.

In the meantime, here are some more interesting locations to keep you busy:

Disabling the break key. POKE 16,64 and POKE 53774,64 to disable the break key. Very handy to keep users from interrupting or getting into a program.

Disabling DMA. PEEK (559), then POKE 559,0. This will shut down Antic, allowing the 6502 to speed execution dramatically. POKE 559 with value initially PEEKed to re-enable screen display. Also handy as a "curtain," in concealing the screen during display initialization or other potentially distracting moment. This is as opposed, for example, to resetting graphics mode and setting color registers to black.

Putting a text window into graphics 0. POKE 703,4. This will force all normal text into a text window as in graphics modes. Printing to the upper part of the screen must be accomplished with PRINT #6 statements. Could be handy in writing text adventures (maybe even with the multicolor font). To return to default, POKE 703,24.

Flashing characters. Set up a loop wherein the value of location 755 varies from the normal, 2, to 1. Figure 2 is an approach to flashing characters.

It is a nice attention getter in programs. We will also look at more sophisticated means of obtaining flashing characters in an upcoming column.

Checking for keypresses. POKE 764,255, then PEEK(764) for internal keycode. Handy to check for any or a specific keypress. Can also be used to "press a key" through software: for example, POKE 764,12 will RETURN automatically.

To enable cassette recorder. POKE 54018,52 to turn cassette play on, POKE 54018,60 to turn it off. Recorder must, of course, be set with cassette in place and play key pressed. Use to sync recorded sound with programs.

Next month we'll look at some new hardware for the Atari from third-party sources, new game software, and present a title card generator program. Until then, keep your computing creative! ☐

FRANK ZUBEK

"Harry, the repairman said it would be two more days on your Atari. You can't just sit here!"

mages...ibm images...ibm im

Will Fastie

It's very hard to believe that I have been here for a year, but it's very true. I expect to be here for the next year too, provided I am not forced to go on strike for better working conditions or more money. I am sure such an action can be averted; my attorneys are working around the clock with *Creative's* management team to thrash out an agreement. I hear *PC* is looking for writers. . .

Last month, I ran out of space. This month, I am finishing up with personal finance packages and a few other odds and ends of general interest. First, however, I have to tell you about something very, very exciting.

I consider myself very lucky, and very privileged, to have been given a demonstration copy of a new piece of software for the IBM Personal Computer. The program is from Microsoft. It is Bruce Artwick's *Flight Simulator.*

Mr. Artwick is the brain trust behind the SubLogic flight simulator, a program which is available for Apple II and TRS-80 computers. The IBM version is not merely a cut above those, it is an order of magnitude beyond them. It is fantastic. It is a sight to see, and a trip to fly. You absolutely must see it, and by the time you read this, your local dealer should have a copy along with an in-store demonstrator. To run this program, you need a 64K, single disk system with the color/graphics adapter. You also need $50 to buy it. If you have ever wanted to fly, you'll never regret the price.

Next month, *Creative* will carry my in-depth review of the simulator. I had hoped to have it ready for this issue, but I have been using a prototype and it lacks many of the features that will be in the final version. Of course, you may infer from my tone how I feel about the program, so you might not need the review, eh?

Oh, by the way, for those of you who do not know what I'm talking about, the flight simulator is a program that puts you in the cockpit of a light plane, with a full instrument panel and an out-of-the-window display of the world. You are the pilot, and you fly the plane. Believe me, you really do.

Personal Finance Programs

January is the month many of us begin to think about taxes and our budgets for the forthcoming year, especially if the IRS has mailed out tax return booklets with their usual promptness. I can always be found under a mountain of paper, sorting stubs, calculating interest, and wondering how I could have let my records get into such a state of disarray.

Last year was particularly bad because I procrastinated while I fooled around with the notion of writing a complete record-keeping system for my personal use, one tuned to my special needs. I gave up, not because I couldn't do it but because I was sure some responsible programs would pop up that I could buy.

That was not to be. It has been only in the last three months or so that personal financial programs have found their way to the IBM PC market, perhaps because of a perception that the consumer acceptance of the PC did not represent a significant enough market opportunity. Apparently, that perception is changing because five companies have provided home finance programs for review, and there are several others in the works.

With the five programs in front of me, I had only to decide how best to evaluate them. Just what criteria are important, and on what basis should a consumer make a choice between these products? For me, there are just two criteria, and everything else is a minor detail.

The first consideration is functionality. Now I don't mean features: a program does not have to include every possible bell and whistle to be considered functionally complete. Functionality means that the software performs as specified, and that that specification meets a fundamental requirement, as determined by you, the buyer.

Is the package going to solve *your* problem, and will it do so to the extent that it performs useful work for you? And if the program passes that test, do the other features provided, the ones that are beyond your basic requirements, enhance the product, or are they just eye-catching, without real value and thus unlikely to be used?

These five packages cost from $100 to $200. More important, you will spend a great deal of time with the one you choose if you use it as intended. You owe it to yourself to examine the alternatives carefully, and make a reasoned choice. Make sure the function makes the investment worthwhile.

The second point is human engineering. You will hear a lot about that from me, and I consider it one of the major issues in computing today. You have a right to expect a program with which you must become intimate to be well engineered.

You should not tolerate a program that does unexpected things, fails, does not explain itself, provides more

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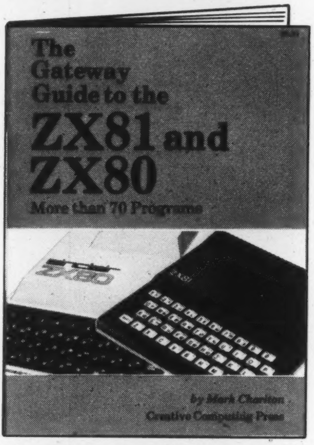
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than one way to accomplish the same thing, or always expects you to know exactly what to do next.

You *should* expect the program to deal with *any* error encountered, provide you with information if you need it, provide you with assistance if you need it, and let you back out of any situation gracefully, all the while telling you what it is doing.

You should always be able to tell at a glance if the program is waiting for you or working. You should always have the feeling that the situtation is under control and that the program is protecting your interests (and data).

Can you easily tell that a program is well engineered? Yes, usually you can, just by spending a little time at the computer trying it out. And I don't mean running a demo version either, I mean trying the real thing. You will feel it and see it. You will know that you and the program can work together and that the program will not be at odds with you. Sound like dealing with another person? Well, not quite, but it *is* an interaction. Expect a program to be *well behaved*, just like the kind of person with whom you enjoy dealing.

Why am I spending so much time harping on this subject? (See, I really do know what you are thinking.) Because it is important for programs in general, because it is especially important for a program with which extended interaction is required, and because I am generally disappointed with the human engineering of these five finance programs.

The five programs I tested are listed in the various tables accompanying this column. I think the tables provide most of the information from which you can develop your own opinion. Because all the programs provide an acceptable degree of functionality, an examination of the human factors provides considerably more insight. That's what I want to concentrate on.

Of the five programs, one is a clear leader, three fall in the middle, and one is a clear loser. I'll not keep you in suspense: *Money Maestro* is by far the easiest to use, the most forgiving, and the most carefully engineered. *Home Finance Program* is the loser. *Financier, PC/HFP,* and *Home Accountant Plus* are acceptable.

As a first clue as to why *Money Maestro* is on the top of my heap, consider that it is the only one of the five that can be invoked by typing its name, even though the use of a .BAT file under IBM DOS makes such an invocation easy to provide for any program.

Let's look at these programs in reverse order.

Home Finance Program

What I have to say about this program is very limited, because I spent the least amount of time with it. The reason was simple. This program failed in two ways in less than 20 minutes of use, and I consider that so unacceptable that I stopped wasting my time.

The first problem popped up when I tried to enter a comma in the middle of a text string. The text being entered was the description of a check, and the entry was "J. W. Rouse & Co., Inc."Now that seems quite reasonable to me, but the program responded with "Too many data items, ?redo from start," the Basic message emitted when too many entries have been made to an INPUT statement. I could not find a warning about using commas in text input in the manual, in either the section pertaining to the function I was testing or other sections.

The second problem was a crash: in other words, the program stopped running. When this happened, the program returned to Basic, and a standard Basic error message was emitted. These messages give the line number of the error, but unfortunately, this program is protected, so the average user cannot look to see just what is wrong. After this crash, I retired the program.

An aside: Basic files can be unprotected. For $10, Data Base Decisions, 14 Bonnie Lane, Atlanta, GA 30328, will tell you how. It's simple. These folks were just quick to figure it out and I figure they deserve ten bucks a shot for the answer.

A couple of specific complaints. The manual was generally good. It contains clear instructions and is well formatted. However, it nowhere explained what the package included, and did not indicate what the second disk, labelled Data Disk was for. The bigger complaint is that the program does not take advantage of two diskette drives if the system has them. Instead, it requires that the user constantly switch between the program and data disk in drive A — something I consider very irritating.

Three In The Middle

Now we come to the three programs which are acceptable. In each case, they provide a set of functions which is reasonable for home financial management, and which operate tolerably well. General information about each package is in Table 1 and the functions performed by each can be found in Table 2.

PC/PFP by Best Programs is the least expensive of the lot at $95. It is well-documented, with a nicely type-

set manual in traditional (by now) IBM style. It is printed with two colors, so explanations and examples are clearly differentiated. The program runs smoothly, and always presents clear, easy to understand prompts.

Functionally, *PC/PFP* is complete. Practically, it is somewhat limited by the number of budget categories provided. It allows 45 categories, 5 of which are for income and the rest of which are for expenses and credit cards. For my personal finances, this is not enough. I had to lump things together in generic categories, making later analysis more difficult.

There is also a limitation of ten tax deduction categories — also a problem for me. Remember that for tax purposes I have a business operation, so I need a little more flexibility. The average consumer might do fine within these limits.

This package suffers mostly from a lack of consistency. This can be found quickly. Some replies to menu prompts require the entry of a number or letter followed by a RETURN (or ENTER, if you prefer), but some take action as soon as the letter is typed.

Because DOS and Basic are buffering keystrokes, a number followed by a RETURN when the RETURN is not required lets the RETURN pass to the next prompt. This can cause the program to go somewhere you weren't expecting. There are other examples of inconsistency.

On the whole, the program is well done, and a good value. It has one strong feature called "split transaction," which allows a single check to cover two or more expenses in different expense categories. This is very convenient for dealing with credit cards.

The Home Accountant Plus from Continental Software is next up the price line at $150. The program supports up to 100 budget categories and 5 checkbooks (a strong feature), can account for assets and liabilities, and can print a net worth statement. Although the program limits the data storage to 1000 transactions per disk, it allows multiple disks to be used.

It is also unique in that it can present graphs on either a text device (like the monochrome display) or a graphics device, and for the latter produces very nice looking graphs in full color.

The program seems to be the most fully featured of the five, and would have earned more of my attention had it not been somewhat difficult to use. At first, this seemed not to be the case. The program, for example, blinks items in a menu if they are the next required thing to do, and refuses to accept any command but that one.

The first time I ran the program it forced me to tell it about my system configuration, and how I planned to use it (e.g., which disk drives would be used for program and data disks). That looked pretty good, but the program fell down later during data entry.

Although clear instructions are provided on every screen display, the action you need to take is not always obvious. Also, sometimes the menu is split, with part of it above the data entry portion of the screen and part of it below. The reason for that escapes me, and I found it confusing.

The document is extensive, an obvious attempt to do well, but I found it difficult to follow. I would have been helped by an index. The information is there, it is just a little tough to find sometimes.

The program can print checks, and comes with a sample and an order form from Nebs Computer Forms, a nice touch.

The Financier from Financier (the first i in both is supposed to be an up-arrow) costs $180. I consider it a little better than *PC/PFP* or *Home Accountant Plus* because it makes a stab at improved human interface. Unfortunately, it does not go all the way.

Again, we have a program with some strong features and good functionality. It also allows split transactions, except it is limited to nine expenses for a single check. A complete set of reports, both summary and detail, is provided.

Each category has a name and a code. In *The Financier* the code is four letters. The program can build reports based on the alphabetical nature of these codes. If all deductions for tax purposes begin with the letter D, they can be recovered by specifying a code range of D to DZZZ. But that reduces the mnemonic value of the codes by eliminating a letter.

Furthermore, it forces extremely careful advance planning to assure that codes which logically relate to

Table 1. Personal Finance Package General Information.

Product Name	Home Finance Program	PC/HFP	Home Accountant+	Financier	Money Maestro
Manufacturer	Design Data	Best Programs	Continental Software	Financier	InnoSys
Price	$100	$95	$150	$180	$200
System Required	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic
Display Width	80	80	49/80	80	40/80
Written in	Basic	Basic	Basic	Basic	Forth
Functionality	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Human Interface	Needs improvement	Acceptable	Sometimes confusing	Acceptable	Excellent
Documentation	Satisfactory	Very good	Complete, but hard to use	Good	Poor because not written for PC
Overall Impression	Unacceptable as tested	Satisfactory, good value	Satisfactory	Satisfactory, some excellent features	A little expensive, considering features

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each other also relate together alphabetically. That is irrational, because no such relationship exists naturally.

The strongest feature of this product is its ability to list the categories whenever it asks you to enter one. That gives you a way to refresh your memory without having to have a list of all the current categories at hand. That is very good. But is is also limited.

The listing shows only the codes, not the description. If a code is particularly cryptic, and some are bound to be, you might still not know what it means. Also, this feature works only when entering budget codes and does not work for tax codes. The listing is obtained by depressing the RETURN key instead of a code. Since tax codes are optional entries in transactions, RETURN is a legal response and does not mean "tell me the options."

This is pretty much the stab *The Financier* took. It is helpful in its current form, but it could be so much better.

The four programs mentioned so far have one thing in common. They are written in Basic. They impress me as programs written by financial experts, even people who have a notion of how they would like to see a program work. However, they do not impress me as programs written by professional programmers or computer scientists. And Basic provides one other unfortunate side-effect: the programs are not very fast, a problem for any interactive program.

Money Maestro

This program, on the other hand, does impress me as a professionally implemented system. Above all other things, this InnoSys product runs smoothly and is extraordinarily well behaved. Of the five programs, it is the only one that can be operated successfully without reading the manual.

The power of the human interface in *Money Maestro* is that is listens carefully to what you type and deals with those inputs in a context. Furthermore, the program can provide help at any time if a question mark is typed, and the user can gracefully withdraw from any point simply by pressing the Esc key.

The help feature is super. For example, when entering a transaction, a budget category must be entered. If you are not certain which one you want, hit ? and *Maestro* tells you that it wants a category. It also tells you that it will list all the ones it knows about if you'd like. So you do, and you find one you like. At that point, you can use Esc to pop back to the original question, or you can just enter

Table 2. Personal Finance Package Features.

Product Name	Home Finance Program	PC/HFP	Home Accountant+	Financier	Money Maestro
Accept upper and lower case?	Yes	Yes	No	Yes	Yes
Number of budget categories	14 pre-defined, 10 subcategories in each	46	100	32,767 or limit of disk	Approx. 200
Transaction storage per 160K diskette	unknown	2400 (200 per month)	1000 multiple disks allowed	1200-1500 multiple disks allowed	Approx. 1250
Credit card management?	No	Yes	Yes	Yes	Yes
Split transactions?	No	Yes	Yes	Yes	No
Forecasting?	Yes	No	Yes	No	No
Reports					
Paginated?	(1)	Yes	Yes	Yes	No
Binding margin?		No	No	No	No
Check register?		Yes	Yes	Yes	No
List of codes?		Yes	Yes	Yes	Yes
Income statement?		Yes	Yes	Yes	No
Balance sheet/ net worth?		No	Yes	Yes (2)	Yes (2)
Cash flows?		Bar graphs income and expense summaries	Screen graphs	No	No
Budget performance?		Yes	Yes	Yes	Yes
Tax report?		Yes	Yes	Yes	Yes

(1) Home Finance Program does not provide a report function. Hard copy of displayed data may be obtained with the PC PrtSc functions.

(2) Function available if budget codes are properly set up. Program does not provide function automatically.

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About the author:

Stephen J. Rogowski is a noted computer lecturer, author of more than a half-dozen books and 50 articles on computing, as well as a licensed pilot and FAA certified ground instructor.

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the code immediately. The program knows that you mean for the code to be used in the transaction. If you were just listing all the categories, which happens to look the same, the program would ignore an entered code.

But there is more. When asked for a budget category, you don't have to give the code number. You can give the *name* or just the first few letters of the name. If *Maestro* can find something that matches, it automatically assumes that is what you want (although you can use Esc to back it out if you were wrong).

If there is more than one category which matches the entered name, *Maestro* tells you that your name was "ambiguous." A little stuffy, but the program immediately pacifies you with a list of all the matching categories, *showing both code and description*, and asks you to choose one.

Make all the mistakes you want with this program. You can always back up, and you can always yell for help. The prompts are very descriptive, and the displayed instructions are clear.

The program has two operational modes. While you are learning the system, and before you know any better, you will just answer all the questions as they are asked. However, you can use an expert mode which allows answers to be given in advance, thus avoiding prompts. This is very clever, and very easy to learn. But if you forget, you can just revert to answering all the questions. Have it your way.

There are many more examples of this attention to the human interface in *Money Maestro*. I particularly like the way it handles the printing of checks. However, the program is not without its problems. First, it is not as functional as its competitors and it carries a higher price tag, $200.

In particular, it does not handle split transactions and does not allow transaction data to be modified once entered. Second, the manual is poorly done, and has not been revised for the IBM version. It is still in its CP/M form, and it won't make much sense to an IBM owner. Third, neither the program nor the manual provides a mechanism to get the data files on a separate disk. To the naive user, it would seem as if the data *had* to be on the same disk as the program. Finally, the reports are not paginated, do not output form feeds to leave the paper lined up, and do not provide a margin for binding in a three-ring binder, the most likely binder to be found in a household. (None of the other programs provides a margin either.)

InoSys is currently revising the manual, a difficult task because the program is supported on Apple, CP/M, and IBM systems. The company expected to have the new document ready by the time you read this. A revised and extended version of the program is due out sometime early next year.

One final point. The *Maestro* data files are kept in an ASCII format that is very easy for Basic to read. That means you can build your own programs to provide specially formatted reports or other functions you might want that the program as delivered does not. The format of each of the files is described in detail in the manual.

Question: which program wins? Answer: none of them. After having

On Disks and Diskettes

I have become somewhat cramped on my 160K single sided disks, and I am beginning to feel that an investment in double sided disk drives is warranted. My search for a way to convert to the bigger disks at minimal cost has turned up an interesting possibility.

Many companies sell the bigger disk drive. They are available from IBM for $650 and, of course, IBM will maintain and support them if you buy that way. However, the price of the bare disk drive on the open market ranges from $275 to $325. That makes the IBM deal look awful. I have even considered the fact that for two years worth of maintenance fees I could afford to junk a failed drive and replace it with a new one.

Either way, I would still be stuck with my old drives. IBM does have a trade-in policy, but it expires January 31, 1983.

You may remember that I bought my second drive from VR Data. This company will take your 160K drive (IBM or other as long as it is a Tandon 100-1) and $199 and send you a Tandon 100-2, the double sided version. VR Data also sells the bigger drives for $399.

VR Data resells the smaller drives in the TRS-80 market, and there might be some deals lurking here for owners of Model I or III computers.

As for disks, I have now had the opportunity to use several different brands and I thought I would report on my experience to date. I use Radio Shack diskettes (catalog number 26-0305, $39.95 in boxes of ten) extensively, and I have had not a single failure of any kind.

The DOS FORMAT program has never found bad sectors on a Radio Shack disk. Furthermore, my friend Tom uses them in his double sided disk drives, even though Radio Shack only certifies the disks as single sided. He has also had no difficulty. Tom, Rich, and I have used about 120 of these disks without problem.

I have purchased a few Dysan disks (104/1S, 104/1D). I am really sorry to have to say that they have been nothing but trouble. I have had about a 50% fallout rate with them, and a few have been very difficult to format. I say I'm sorry because I have used Dysan disks (and other Dysan media) in the past with extraordinary success, to the extent that I would buy only Dysan 8" disks. I don't know what's going on here.

Verbatim disks are in use on the PC in my office and in a few other small systems, and they have been excellent. I would actually prefer to buy Verbatim over Radio Shack, but I have a harder time finding them in small quantities and then they are more expensive by about $5. Radio Shack is so convenient.

Two other brands are frequently found in software I receive for review. They are Memorex and Elephant. Both seem to hold up pretty well, although my use of them has not been hard. Elephant disks are certainly inexpensive.

Whatever disks you decide to buy, keep track of them carefully so that if they start to fail you can identify the lot. Then find all the disks purchased with that lot and use them for less critical storage requirements. Cyclic backups are a good idea in general, but if you are having any media problems you should religiously duplicate your data. And don't forget to register a complaint with whoever sold those disks to you in the first place. □

tried all the programs, I am not convinced that my accounting work will be eased or reduced. My manual system is rather efficient; for example, I have not had a checkbook reconcilliation error in years.

Furthermore, any program I use has to be usable by my wife, who will not tolerate unnecessary work and will not spend the time to become an expert operator. So for her, *Money Maestro* would be best, but it is not a total solution for our needs.

Ah, well, maybe I *will* write my own after all.

New Products

As time goes on, the size of this section of the column will shrink. The reason is lead time and space, too much of the former and too little of the latter. Most of what I can talk about here will probably already be known to most of you, either through ads or because you have seen the things in stores. What I will carry are items I think have particular interest, or ones that are unique.

IBM has announced SNA 3270 Emulation and RJE support ($700, chalk up one for me) and IBM 3101 emulation ($140), as well as Version 2.0 of the Asynchronous Communications Support package ($60).

An SDLC Communications Adapter ($300) had also been announced, along with a cable ($75). These products, mentioned by IBM as "intentions" at the time the PC was announced, are important additions that allow IBM to continue their penetration in their own large accounts.

In the same vein, Persyst Inc. announced PC/HASP, a multi-user remote job entry HASP workstation

My Favorite Full-Screen Program Editor

A new full-screen program editor has been announced by Satellite Software International (SSI), of Orem, UT. The $195 program, called *P-Edit* (pronounced pea-edit), is my favorite editor, and the one I could not tell you about until now.

SSI has been in business for several years building software products for Data General computers. Although I have tried *P-Edit* on a DG system before, I had not used the program extensively until it became available on the IBM PC. What a mistake. I am now in the process of acquiring it for my DG system at work.

For any software product, and especially for interactive programs, there are two qualities that will distinguish it from the rest of the pack. I have mentioned them in the body of the column: they are good functional match with your requirements, and good human engineering. *P-Edit* has both.

P-Edit has all the features a programmer needs, and most that a programmer wants. Editing is simple, but the program can be taught to perform very complex procedures with SSI's macro facility. The better editors *(PMATE, Vedit)* have similar facilities, but they are not as easy to use as *P-Edit's*.

A procedure is defined for *P-Edit* by manually performing it once. *P-Edit* records the sequence, and can store it temporarily, or permanently if a name is provided. The procedure can then be invoked at any subsequent time. Temporary macros are particularly nice because they are deleted at the end of the editing session. Often there are procedures that are unique to a particular file and only need to be performed once.

The best part of *P-Edit* is the human engineering. Although I think there is room for improvement, *P-Edit* is very easy to use and understand, and very forgiving of errors. It is function key driven, meaning that keys are depressed to invoke functions, as opposed to typing commands or keying code letters.

SSI provides a "template," a paper (I wish it was plastic for durability) form that sits above the keys and identifies which functions are invoked with which keys. *P-Edit* uses primarily Alt-1 through Alt-= (the top row of keys), and also makes use of a few of the left-most function keys.

The most outstanding feature is cursor positioning, which can be performed on the cursor pad very rapidly. Arrow keys move the cursor one character in the direction indicated. They can also be prefaced with a depression of the Home key, which moves the cursor to the top, bottom, left, or right of the screen in the direction indicated. A double depression of Home followed by an arrow moves the cursor to the top or bottom of the file being edited, or the left-most or right-most character in the line. This sounds complicated to explain, but it is so easy and natural to use you can only be amazed.

Other features of *P-Edit* include horizontal scrolling to accommodate line widths of over 80 columns, powerful (but a little different) block movement functions, fast (not the fastest) scrolling through the text, and files of arbitrary length. All this in a program which is 16K long and requires only 48K of memory to operate.

One feature not included in *P-Edit* is split screen editing, or multiple windows. This feature usually allows more than one file to be edited at the same time so that a section of one file can be moved or copied into another. Strangely enough, this would be a relatively simple thing to add to *P-Edit* because memory is not a problem for the program — I guess SSI doesn't see any value in the feature.

Multiple editing is a nice "gee-whiz" feature which, in my experience, is rarely used. *P-Edit* certainly allows other files to be inserted in the text being edited, so the function can be had by doing several independent edits. Split screen editing, giving the ability to look at one section of the file while editing another, is a feature I do wish SSI had included, but the program scrolls through the text rapidly enough to offset the lack of that function.

Finally, *P-Edit* is the tip of the SSI iceberg. SSI's main product for Data General systems is *WordPerfect*, a terrific word processor. I don't know when it will be ready (I hope soon), but SSI is currently working on the IBM conversion. I have to reserve judgment until I have a chance to review the product, but if they don't make any mistakes they will have the premiere word processor on the small systems market and, of course, it will run in MS-DOS, making it easily available on a vast number of the new generation of micros. ☐

emulator. The package costs $995 and requires Persyst's DCP/88 Communications Processor card. This device uses an 8088 and up to 64K of on-board RAM, and can support line speeds up to 50 kilobaud. When not being used to run PC/HASP, the board can be used as an outboard processor. Price of the DCP/88 was not available at press time.

By the way, Persyst also manufactures add-in memory and multifunction cards. Their Spectrum series is particularly interesting because it is the only card I know of that provides *two* communication ports. Their 256K board with two ports is $985. A printer port is also available on the same card, and Persyst now offers an electronic disk simulator called Insta-Drive packaged with their boards or separately for $49.95.

Curtis Manufacturing Company, Inc. offers the P.C. Pedestal. This $79.95 item is a very attractive stand that attaches to the bottom of the IBM Monochrome display, allowing it to be tilted or rotated for the optimum viewing angle. Slots, visible in Photo 1, assure adequate cooling to the display. A display extension cable set, which allows the display to be located further away from the system unit, is also available for $49.95. I have one of these units, and it is very nice indeed. It is of very high quality. The cables are very well built. The color of the stand matches the IBM perfectly. Frankly, if you decide to move the system unit away from the keyboard and display, this item is a must because the display is too low if it is not sitting on the system unit.

Nat Hellman III, Incorporated, has announced several accessories for the IBM PC. Their keyboard cover ($12) is made of rigid, smoked plastic and fits neatly over the keyboards of IBM and several other computers and terminals. A clever little disk cover ($8) protects the disk drive area from dust. A manual rack ($24) holds six IBM manuals. Finally, a carrying case ($120) secures the keyboard, system unit, disks and manuals for transport. Photo 2 shows the items.

Photo 1. P.C. Pedestal, from Curtis Manufacturing.

Columbia microSystems, Inc. announced the CMS 1600-IBM disk subsystem for the PC. The product provides two 8" double sided, double density disks in a thin (2.5" high) cabinet for a storage capacity of 2.4 megabytes. The unit is compatible with the standard IBM single density format, according to the manufacturer. The price of the system is $1750. With controller and software, the price is $2095. The unit can be seen in Photo 3.

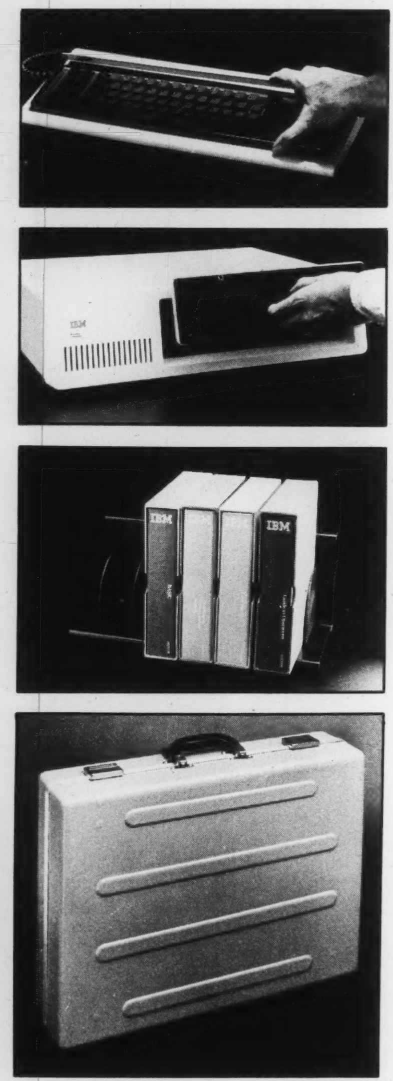

Photo 2. Accessories from Nat Hellman III, Inc.: a) Keyboard Cover; b) Diskette Cover; c) Manual Rack; d) Carrying Case.

CMS - IBM
8IN - 2.4MB

Photo 3: Columbia microSystems' CMS-1600-IBM 8" diskette subsystem

Personal Data Systems, Inc. has announced the PACK-HDR-R disk drive, using the SyQuest 306 *removable* cartridge drive. The hard disk unit has a formatted capacity of 5 Mb with an average access time of 75 milliseconds. The price of $1795 includes a software interface to PC DOS or CP/M-86. Disk Cartridges are expected to be in the $35 price range.

The drive mounts in the system unit where diskette drive B: would normally go. I consider this product significant because it provides a considerable degree of flexibility over a conventional non-removable hard disk, and the price is agressive.

Orchid Technology has announced two new products. The start-up firm offers a graphics card for the IBM Monochrome display for $495. Graphic resolution is 720 horizontal by 320 vertical. The card also includes the Game Adapter, and complete software support for Basic, Pascal, Fortran, and other high-level languages.

The second product is exciting. Called PCnet, the $699 product allows the integration of a local area network. Using baseband technology, the device operates at speeds up to 1 million bits per second over a distance of up to 7000 feet. An addressing scheme which allows 64,000 addresses assures virtually unlimited expansion of the network. Operating software is provided which allows resource sharing of devices such as printers or hard disks.

Forth, Inc. has broken the mold and is now offering a new version of Forth called personalForth. The new product is Forth Inc.'s first mass market product and carries a price of $300. The list of features sounds impressive, including multi-tasking, screen editor,

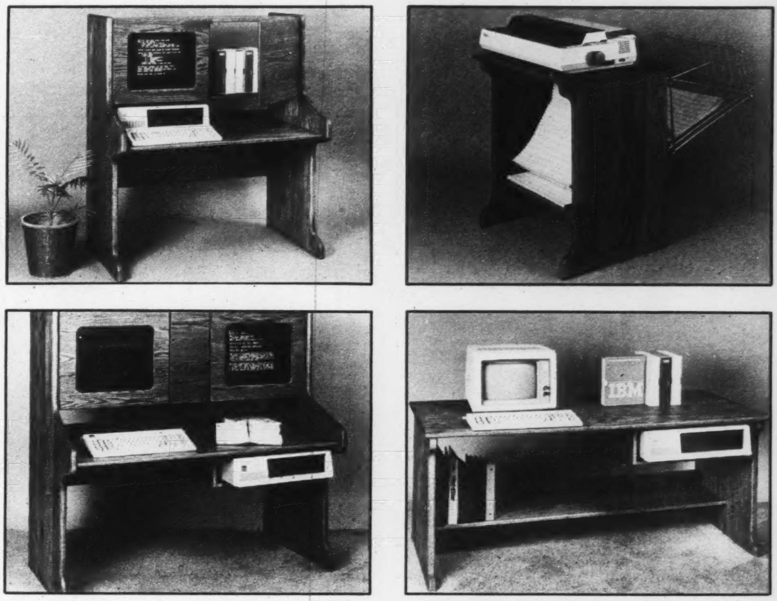

Photo 4: Bench Collection Furniture: a) Model A Desk; b) Model A Printer Stand; c) Model B Desk with optional CPU Shelf and extra glass door; d) Model T Table with optional CPU Shelf.

IBM DOS file handler, a special "turnkey" compiler, new documentation, and 8087 support (software emulation of the 8087 is *not* provided). The program requires as little as 48K of memory and supports either type of display, two diskette drives, and the printer.

The Bench Collection has announced Electroniture, a series of computer furniture products. Pictured in Photo 4 are four products relating to the IBM PC. All the furniture is made of solid oak and has been designed with the comfort of the user in mind. Price of the Model A Desk is $895. I have seen a color photograph of one of the products and it looks beautiful. My table (remember my table?) is oak too, but I think Sandy would prefer one of these. ☐

Firms mentioned in this column:

Microsoft Corporation
10700 Northup Way
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(206) 828-8080

Design Data Systems Corporation
5270 N. Park Pl. N.E.
Cedar Rapids, IA 52402
(319) 373-1571

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Orchid Technology
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(408) 942-8660

Personal Data Systems, Inc.
1110 Wrigley
Milpitas, CA 95035
(408) 262-7880

The Dyna-Logic Hyperion Portable Computer

The Hyperion Portable Computer is a new entry in the portable computer sweepstakes that I consider very significant because of Dyna-Logic's claim of total IBM PC functional compatibility. I've mentioned the details in a previous column, but I failed to include the photograph. Here it is.

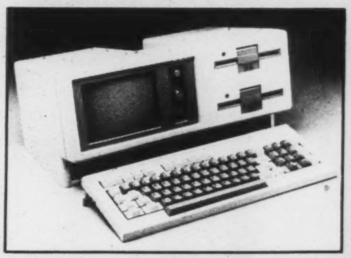

Photo 5. The Hyperion Portable Computer, from Dynalogic Info-Tech Corporation.

the other side...the othe si

Guy Kewney

There are, maybe, some 500 IBM PC users in Britain. Not one has bought the kit from IBM.

That in itself is only slightly strange. Where things start getting weird, however, is in the various silly battles that are going on, with people falling over their own toes in an effort to flatter, court, woo, and even intimidate IBM.

What companies say in public (that is, when a journalist asks) and what employees in the company say to each other, don't often match. IBM's way round this is to say nothing to journalists. Other people, however, talk to IBM and then they talk to journalists, and from that, quite often, one can glean some idea of what is going on.

Not this time. From the leading software producers in Britain, you can be told alternately that "IBM will not launch the PC in the UK, ever" or that "IBM will launch tomorrow." I could eat for a week if I got a free lunch for every time I've been told that. So what—it's always like that when IBM prepares a new product.

This time, however, it is a good deal sillier. Like: "We have a wide range of IBM branded software" (a Peachtree employee talking) "which has all been rewritten to UK standards of accounting and business practice, but I'm afraid we couldn't sell it to you, even if you had a PC."

The reason? Apparently IBM will not grant Peachtree UK a dealer license to sell the PC if Peachtree supplies software to IBM PC users who buy direct from the States.

No, I don't believe it either, and my contacts inside IBM (who don't talk to journalists) are equally at a loss to explain this one. After all, if you could guarantee to have some ready-debugged software for your machine, with a couple of months' user maturity, ready when you launched, even Osborne might launch a 16-bit machine.

The people IBM really are getting hot under the collar about are those who take very large advertising spreads in the trade papers, using phrases like "official dealer" who haven't even (say my contacts who don't talk to journalists) phoned IBM to ask if, one day, they may be dealers.

My own feeling is still to wonder at the enthusiasm for such a high-priced bit of hardware with so few special features, with nothing much to run beyond *VisiCalc* and a translation of *Wordstar*—and if you're a fan of the PC, remember that you will have to spend the equivalent of over $5000 to get one here, at least until IBM announces the beast.

Software for the IBM still comes through very slowly. Software for "any Z80 based machine that runs standard CP/M," however, continues to pour through the faucets. The latest is virtual APL.

Virtual APL

It is always a bit hard to start writing about APL to anybody who doesn't use it, because APL users don't just use their language, they worship it, write diaries in it, and define anything from trade exhibition stands to printed circuit boards, as well as merely writing programs in it.

To the serious APL freak, however, the limitation of using the language on micros will always be the smallness of the workspace—the well-known Micro-APL, for instance, offers about 22K in a standard 64K memory map.

At the APL '82 conference in Heidelberg, at which IBM made part of the headlines by releasing APL II, a small British firm called Sigma Software Unit produced a £225 sterling interpreter which offers a megabyte of workspace. Not unnaturally, they caught the other half of the headlines.

VIZ-APL, as Sigma's product is called, is to be marketed in the US by EASI APL Systems Inc., a "recursive" acronym since it includes itself. It achieves the magic by the old trick which IBM invented, of using "virtual memory," but does it on diskettes, which is quite a new trick.

Director Geoffrey Roughton of Sigma says that the interpreter got "the best beta testing you could imagine at Heidelberg, with all the world's top APL enthusiasts doing their best to catch it out."

Apparently the speed of VIZ-APL is comparable with normal Micro-APL unless you do a lot of backward and forward jumps in your program. So don't do it.

More On the BBC Micro

On the British hardware front, the British Broadcasting Corporation's micro has just ended a ten-month famine by moving instantly into glut.

Acorn, the builders, are tearing their hair out, since the machine has been in such short supply (people waiting six to eight months before finding that their credit card application has been cancelled because they had moved in the interim) that just nobody will believe their advertising campaign saying the thing is available.

Acorn is also about to get a severe

shock, if and when the user group takes it to court for trying to charge £10 sterling extra for the operating system upgrade ROM.

The initial manual had more page omissions than pages, and the original Machine Operating System was rather similar in design concept. It wouldn't run disks until July, and only now are users starting to get the necessary firmware to do this.

Not unnaturally, users feel that the original machine, as supplied, fell short of spec, and they don't see why they should have to pay for the privilege of getting what they ordered in the first place.

I think Acorn would agree, except for the fact that version 0.1, now replaced by 1.0, is not the last version to need replacing. Version 1.0 is being burned into EPROM, pending the final ROM design (nobody can say when). And the EPROMs are slower to produce, more costly, and set a nasty precedent, if Acorn supplies them free.

Over The Rainbow

By the time you read this, the ROMs may be ready. Also by the same time, the Rainbow may be seen in the offices of lovers of Digital Equipment CP/M.

The world's second largest computer company (as it has been for about nine months, now) has immensely impressed the market with the cleverness of a system which can run both the new fangled, fancy, non-existent 16-bit software, and also, in case you actually want to do any data processing, the old style, reliable CP/M-80 8-bit stuff.

The world's second largest (etc. etc.) has signally failed to impress, however, with its understanding of this remarkable beast.

At the Personal Computer World Show in London (the biggest micro show in Europe) (see report this issue) the project manager was to be seen frowning over one of the disk drives.

"Let's get this right," said he. "I can see what files are on the second disk, can't I? What do I type?"

You type (all together now): DIR, space, B, colon, return.

"Ah, I see. DIR, space, B, then, what did you say?"

I quite like DEC's plan to sell the Professional as a "truly friendly" machine, but it's one thing to try something out and find it wanting, and it's quite another thing to decide that you know better anyway, and needn't even find out. That company's plans to "restructure this market" sound suspiciously like getting the world into step with DEC.

And they obviously are simply not aware of the difference between a friendly machine without any software, and a rather fragile and unforgiving CP/M beast that comes free with a ton of the stuff.

Espionage

Finally, your visit to Europe this winter, on behalf of the secret intelligence people: You will want, naturally, to blend unobtrusively into the background. Briefing will fit you up with an identity with a nice name like Smith or Schmidt rather than John Doe. Your American accent will pass unnoticed, since most Europeans speak English with that flavor.

The only problem, is: What cover? What occupation should you assume?

I have the answer. You should not, in 1983, pose as a refuse collector over for a symposium, nor as an automobile tycoon looking for an Irish factory to launch a stainless steel wondercar. No, the thing to be is an American software catalogue operator thinking of setting up a warehouse near London Airport.

I didn't know there were so many software catalogue outfits in America until they all came over here to research the market. If you already run one, and were thinking of starting up in Europe, forget it, obviously. But at least, you've missed the crush. ☐

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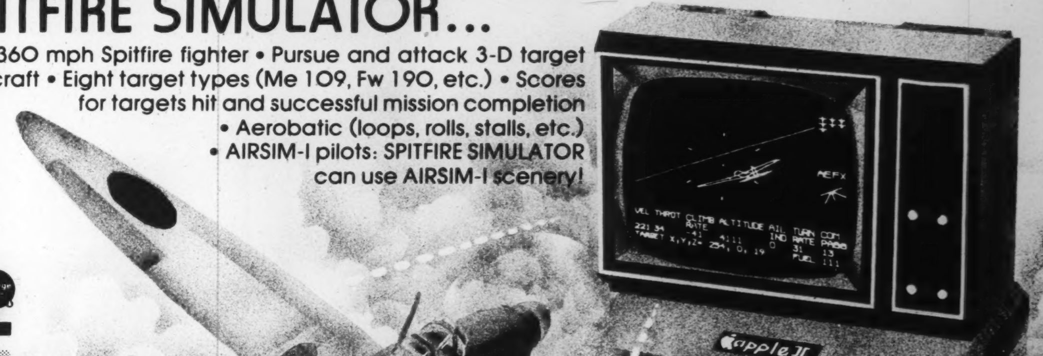
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Personal Electronic Transactions

Marc-Thomas Clifton

I am sure you have heard of the Commodore-64. This month we will take a closer look at Commodore's newest machine.

The 64 comes in the same case as the Vic with the case color changed to a neutral grayish-brown. The keyboard is quieter and has contoured keys and a lighter touch. This is the best Commodore keyboard that I have used. Also, the power supply is outside of the 64, greatly reducing the temptation to use it as a portable toaster. (These improvements are also on the recent Vic's.)

64 Hardware

The 64 has two joystick ports, which can also use paddles, and one of which can also handle a lightpen. Like the Vic, the 64 has the RS-232 port combined with the parallel port. But, the memory expansion slot is *totally* different from that of the Vic, so *none* of the Vic cartridges will work on the 64. An RF modulator is built into the 64, allowing easy TV hookup.

Inside are two new chips to handle the superb graphics and sound capabilities of the 64 and 65535 bytes of memory. When you turn it on, the 64 uses an 8K Basic ROM operating system, giving the user 38911 bytes free for Basic programming. It really does come with 64K of RAM, but the RAM must be selected by POKEing into a control register.

The screen has 25 lines and 40 columns with a border. You can select from 16 colors for the border, screen, and characters. (Eight character colors can be selected directly from the keyboard.) The 64 turns on in a color combination that is similar to the Atari and which is almost illegible on many monitors.

64 Software

There is already one known bug in the Basic operating system of the 64. Basic cannot handle an SPC or TAB function as the first parameter of PRINT#. For example, PRINT#1, SPC(10) will give a SYNTAX ERROR. To fix this bug, put two quote marks before the SPC or TAB. Example: PRINT#1, ""TAB (15). Commodore failed to include any commands to handle graphics, sound or disk operation—just another rehash of Basic 3.0. (I would welcome a cartridge which provides these extensions.)

Border And Screen Color

See Figure 1 for a listing of interesting registers to POKE. First, let's make the screen more readable. Lookup the color chart in Figure 6, and find the numbers corresponding to green and gray#3. POKE the border register to green and the screen register to gray#3. (POKE 53280,5:POKE 53281,15). The program in Listing 1 goes through all the border and screen colors. When you run it, notice which color combinations create legible text.

Elemental Sprites

A sprite is a graphics character that you can make into any shape or color you want. The sprite is made up of 21 rows of pixels (dots) by 24 columns (see Figure 4). The 64 can have up to eight sprites on the screen at once, each with independent position, color, size, and shape.

First, let's draw a picture of a sprite, and then figure out how to put it into a form that the 64 understands. Notice in Figure 2 that the columns are divided into three sections, each containing eight squares. Each of these squares represents a bit and each section of eight bits is called a byte.

So, to draw the first row of Figure 4 into the 64 requires three bytes. The second row takes up another three bytes, and so on, until row 21. So all told, a sprite takes up to 21*3 bytes, or 63 bytes. Now, even though in our picture the sprite has 21 rows, when we put it into memory, all the bytes are in sequential order. Figure 2 shows how the first two rows are translated into memory.

What values go into memory? Let's look at an individual byte. A byte has a numeric range from 0-255, which in binary, is either all the bits off (0), or all the bits on (255). Table 1 shows the decimal value for each of the bits, counting from right to left.

The decimal value is calculated by raising 2 to the power of the bit number. (This is why we start with Bit 0, 2↑0=1). If you have more than just one bit set in a byte, the value of the byte is determined by adding the decimal values of Table 1 that correspond to each bit

---

Marc-Thomas Clifton, P.O. Box 262, Palo Alto, CA, 94302.

turned on. Each bit that is on in the byte corresponds to the pixel appearing on the screen after you have drawn the sprite.

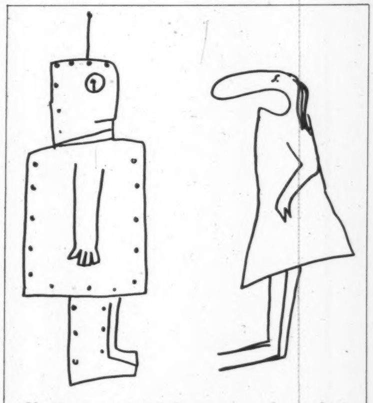
For example, if you wanted the first row to be a solid black line, you would assign the first three bytes the value of 255, which in binary has all the bits on. If you wanted every other pixel on, you would give the byte a value of 170 which in binary is 10101010. (What value would 01010101 be?)

The program in Listing 2 puts a sprite on the screen. Look at the DATA statements, and compare the values of each byte with the pattern of the pixels in Figure 4. After adding up the value of each section in Figure 4, you should get the number in the data statement that corresponds to the row and column of the byte.

After calculating the decimal values of the 63 bytes that make up the sprite, we must decide where to put the bit pattern in the memory of the 64. The sprite pointer register (see Figure 5) tells the 64 where you put the data for the shape. The data address can be found by taking the sprite pointer value and multiplying it by 64. So if we give the sprite pointer a value of 13, the memory location into which we put the sprite will be 13*64, or 832.

Now let's choose a sprite to work with. By POKEing the sprite0 pointer register to 13, the 64 will look for the shape of sprite0 starting at address 832, so the next thing to do is put our data into memory. Lines 1000-1065 in Listing 2 POKE the data appropriately. Now, we have drawn a sprite, found out how to convert it into numbers, POKEd it into memory and told the 64 where it is found in RAM.

The last two things that we must do are to tell the 64 that we want sprite0



"You've got one of the most expensive high-speed RAMs, Harry. Don't tell me you can't remember where you were last night!"

Table 1.

Decimal	Binary
Bit 0: 1	00000001
Bit 1: 2	00000010
Bit 2: 4	00000100
Bit 3: 8	00001000
Bit 4: 16	00010000
Bit 5: 32	00100000
Bit 6: 64	01000000
Bit 7: 128	10000000

Listing 1.

```
10 FOR I = 0 TO 16 : FOR J = 0 TO 16
20 POKE 53280,J : POKE 53281,I
25 FOR K = 1 TO 150 : NEXT
30 GOSUB 50
40 NEXT J,I
45 END
50 POKE 53280,3 : POKE 53281,15
55 PRINT"THE BORDER COLOR VALUE YOU JUST SAW WAS";J
60 PRINT"THE BACKGROUND COLOR VALUE YOU JUST SAW WAS";I
65 RETURN
```

Figure 1.

Register Name	Register Value
Sprite0 column position	53248
Sprite0 row position	53249
Sprite1 column position	53250
Sprite1 row position	53251
Sprite2 column position	53252
Sprite2 row position	53253
Sprite3 column position	53254
Sprite3 row position	53255
Sprite4 column position	53256
Sprite4 row position	53257
Sprite5 column position	53258
Sprite5 row position	53259
Sprite6 column position	53260
Sprite6 row position	53261
Sprite7 column position	53262
Sprite7 row position	53263
Sprite control register	53269
Sprite row expand register	53271
Sprite column expand reg.	53277
Sprite-Sprite collision detect	53278
Border color	53280
Background color	53281
Sprite0 color	53287
Sprite1 color	53288
Sprite2 color	53289
Sprite3 color	53290
Sprite4 color	53291
Sprite5 color	53292
Sprite6 color	53293
Sprite7 color	53294
Sprite0 pointer	2040
Sprite1 pointer	2041
Sprite2 pointer	2042
Sprite3 pointer	2043
Sprite4 pointer	2044
Sprite5 pointer	2045
Sprite6 pointer	2046
Sprite7 pointer	2047

PET/VIC, continued...

Figure 2.

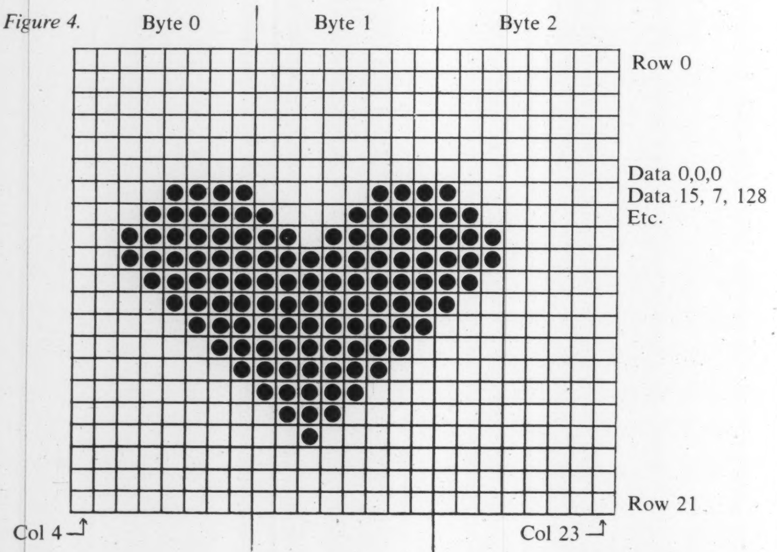
row1,col1 ; row1,col2 ; row1,col3
row2,col1 ; row2,col2 ; row2,col3

. . . . .row1,col1;row1,col2;row1,col3;row2,col1;row2,col2;row2,col3 . . . . .

Figure 3.

Sprite Pointer: register value (10-20)				table address
10	x	64	=	640
11				704
12				768
13				832
14				896
15				960
16				1024
17				1088
18				1152
19				1216
20				1280

Figure 4.



displayed on the screen and to give it a row and column position. In Figure 1, the sprite control register is used to determine which sprite is to be on the screen.

There is only one register to handle all eight sprites, so each bit in the register is assigned to a sprite. Figure 3 gives the layout of the sprite control register. To turn sprite0 on, bit 0 of the control register must be set to 1 by POKEing (sprite control register), 1. (See line 70 in Listing 2.)

The sprite0 column position and sprite0 row position registers are used to place the sprite on the screen. The position of the sprite can be from 0-255 in both the column and row position. The number you POKE into the registers corresponds to the number of pixels across and down starting at the upper lefthand corner of the screen.

To put the sprite at the middle of the screen, POKE (sprite0 column position), 160 and POKE (sprite0 row position), 120. (See line 40 in Listing 2). Type the program in and run it. The sprite will appear in the middle of the screen. Now we can concentrate on moving it, and changing its color and size.

Note: whenever I say POKE (sprite0 color register), 3 or any similar statement, the label sprite0 color register must be replaced with the actual value of the sprite0 color register, or whatever register is in the parentheses. Remember, Figure 1 is the list of all the registers used for sprite manipulation.

First, let's explore moving the sprite in a horizontal direction. Currently, the column position is 160. Try changing it to 159 by POKE (sprite0 column register), 159. Did you see the sprite move over a little? To move the sprite smoothly from left to right, we can write a loop that decrements the column position by one, and has a small delay loop so the sprite doesn't zip across the screen. Try this:

```
FOR I = 159 TO 20 : POKE 53248, I :
FOR J = 1 TO 100 : NEXT J,I
```

Watch the sprite move across the screen. By adjusting the maximum value of J (currently 100), you can make the sprite move faster or slower. Now try moving the sprite vertically. (Hint: it is exactly the same loop, with one number changed.) Now, for our color demonstration, please put the sprite back into the middle of the screen.

Each sprite has a color register which you can use to give it any one of the 16 colors. Each sprite can have a color independent of any other sprite. Find the sprite0 color register in Figure 1, and experiment by POKEing into it values from 0 to 15. Notice that the number you POKE into the color register and the color of the sprite correspond to the chart in Figure 5.

By now, you might also note that the sprite did not scroll off the screen as normal text does, nor did it appear when you cleared the screen. In fact, you can write over the sprite, and the 64 will try to merge the two together. There are two ways to remove a sprite: POKE everything back to zero, or reset the machine.

The 64 can also expand the sprite to double size, in both horizontal and vertical positions. Look up the values for the sprite column and row expand registers. Now POKE (column expand register), 1. Our sprite has just grown taller. Let's try getting it more normal looking: POKE (column expand register), 0:POKE (row expand register), 1. It's stretched the other way. Let's see . . .to get the sprite to lengthen, try the first POKE again. There, now it's twice the size it used to be. (It's up to you to look up the actual numbers this time.)

The expand registers work the same way the sprite control register works, where each bit determines the sprite number, and whether it is expanded (1), or not (0). This way you can control all eight sprite expansions with just two registers.

So far, we have used only one sprite out of the eight. Let's put another sprite on the screen giving it the same shape as sprite0. (I'm lazy), but a different color. To put sprite1 on the screen, POKE the sprite control register so both sprites 0 and 1 will be on (first two bits). Then POKE the sprite1 pointer register to the same data location as sprite0. Type in the lines in Listing 3. (Remember to look up the numbers from Figure 1.)

First notice that sprite0 is twice as large as sprite1. Now take the Basic statements we used to make sprite0 move from left to right, but modifying it so that sprite1 moves from left to right. Watch what happens.

Sprite1 passes behind sprite0. Why? Each sprite has a priority, which tells the 64 if it appears in front or behind another sprite. Sprite0 has priority over all other sprites. Sprite1 has priority over sprites 2-7, etc. Sprite priority can be used to make an airplane fly in front of the sun, but have both airplane and sun disappear behind a cloud. The program in Listing 4 demonstrates priority by putting all eight sprites on the screen at one location, and then moving them in a large circle, each with a different rate of speed.

The sprite collision register is used to determine if sprites have collided. Each bit of the collision register represents a sprite, so when our sprite0 and sprite1 collide, the collision register will contain a 3 (00000011).

Important: Whenever a collision happens, you must reset the collision regis-

"Tonight's guest on Boston Pops will be an ALF 9-voice synthesizer."

Listing 2.

```
10 V=53248
20 POKE V+21,0
30 TBL=13:MEM=TBL*64
40 POKE V,160:POKE V+1,120
50 POKE V+23,1:POKE V+29,1
60 POKE V+39,2
65 POKE 2040,TBL
70 POKE V+21,1
75 FOR I=0 TO 62=READJ:POKE 832+I,J:NEXT
1000 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
1005 DATA 15,7,128
1010 DATA 31,143,192
1015 DATA 63,223,224
1020 DATA 63,255,224
1025 DATA 31,255,192
1030 DATA 15,255,128
1035 DATA 7,255,0
1040 DATA 3,254,0
1045 DATA 1,252,0
1050 DATA 0,248,0
1055 DATA 0,112,0
1060 DATA 0,32,0
1065 DATA 0,0,0,0,0,0,0,0,0
```

Listing 3.

```
POKE (sprite0 col reg),100 : POKE (sprite0 row reg),120
POKE (sprite0 color reg),2 : POKE (sprite1 color reg),6
POKE (sprite1 col reg),200 : POKE (sprite1 row reg),120
```

Figure 5.

Color	Color Value E
black	0
white	1
red	2
cyan	3
purple	4
green	5
blue	6
yellow	7
orange	8
brown	9
light red	10
gray #1	11
gray #2	12
light green	13
light blue	14
gray #3	15

Figure 6.

Sprite control register

1 byte:	0	0	0	0	0	0	0	0
sprite:	7	6	5	4	3	2	1	0

PET/VIC, continued...

ter to 0, otherwise the 64 will think that the sprites are still colliding. The collision register is 0 when there are no collisions. The program in Listing 5 uses collision detection; one sprite (a large box) contains another sprite (a bouncing ball). Whenever the ball hits one of the walls, it sets the collision detection register, and new direction for the ball is chosen.

How The Programs Work

The programs in Listings 4 and 5 were suggested to me by Gregory Yob, and I thought they were excellent demonstrations, so I decided to code them. Space is limited, so these notes are rather terse.

These programs are just a sample of what can be done with sprites. I would enjoy hearing from you if you create any interesting designs, pictures, or animation.

If you write to Gregory Yob, he will pass your letters on to me.

Listing 4

Line 5 reserves variable space for eight pairs of xy coordinates, 0-15.

Line 6 reserves variable space for eight separate rates in which the sprites travel in the circle.

Line 7 defaults the number of iterations to 229.

Line 10 sets up the 64 with a green border and black background.

Line 15 clears the screen and chooses a character color.

Line 20, v is the start of sprite register variable.

Line 21 turns off all sprites.

Line 22 asks the user for the number of iterations; pressing carriage return defaults to 229.

Line 23 is a ratio.

In line 25, the character table address is 13: physical memory location is 13*64.

Line 31 expands all eight sprites in both horizontal and vertical directions.

Line 35 tells the 64 the location of the sprite data tables (they are all in one place).

Line 40 gives each sprite a different color (cyan through light red).

Line 45 is a subroutine which puts each sprite in the middle of the screen.

Line 46 turns all eight sprites on.

Line 50 reprograms them by POKEing data into them.

Line 60 checks if the cycle is complete and if so, ends the program.

Listing 4.

```
5 DIMS(15)
6 DIM I(7)
7 CY=229
10 POKE53280,5:POKE53281,0
15 PRINTCHR$(147);CHR$(159)
20 V=53248
21 POKEV+21,0
22 INPUT"# OF ITERATIONS PER CYCLE";CY
23 IT=CY/6.26666666
24 PRINTCHR$(147)
25 TBL=13:MEM=TBL*64
31 POKEV+23,255:POKEV+29,255
35 FORI=2040TO2047:POKEI,TBL:NEXT
40 FORI=39TO46:POKEV+I,I-36
45 GOSUB85
46 POKEV+21,255
50 FORI=0TO62:READJ:POKEMEM+I,J:NEXT
60 K=K+1:IFK=CY+1THENGOSUB85:END
62 FORI=14TO0STEP-2
63 I(I/2)=I(I/2)+(INT(I/2)+1)/IT
65 S(I)=50*SIN(I(I/2))+160
70 S(I+1)=50*COS(I(I/2))+120
71 POKEV+I,S(I):POKEV+I+1,S(I+1)
75 NEXTI
80 GOTO 60
85 FORI=0TO14STEP2:POKEV+I,160:POKEV+I+1,170:NEXT:RETURN
1000 DATA 0,0,0,0,0,0,0,0,0
1005 DATA 0,255,0,3,129,192,6,0,48,12,0,24,24,0,12,48,0,6,48,0,6,48,0,6
1010 DATA 48,0,6,48,0,6,24,0,12,12,0,24,6,0,48,3,129,192,0,255,0
1015 DATA 0,0,0,0,0,0,0,0,0
```

Listing 5.

```
5 DIMS(3)
8 POKE54296,0:POKE54277,190:POKE54278,248:POKE54273,17
9 POKE54272,37:POKE54276,17
10 POKE53280,5:POKE53281,0
15 PRINTCHR$(147);CHR$(159)
20 V=53248
21 POKEV+21,0
25 TBL=13:MEM=TBL*64
31 POKEV+23,3:POKEV+29,3
35 POKE2040,TBL:POKE2041,TBL+1
40 POKEV+39,4:POKEV+40,13
45 GOSUB85
46 POKEV+21,3
50 FORI=0TO124:READJ:POKEMEM+I,J:NEXT
55 GOSUB95:GOSUB120
60 POKEV,S(0)+X2
61 POKEV+1,S(1)+Y2
65 POKEV+2,S(2)+X1
70 POKEV+3,S(3)+Y1
73 GOSUB150
75 IFPEEK(V+30)=0THENS(2)=S(2)+X1:S(3)=S(3)+Y1:S(0)=S(0)+X2:S(1)
   =S(1)+Y2:GOTO60
76 GOSUB90:POKEV,S(0)-X2:POKEV+1,S(1)-Y2
77 POKEV+2,S(2)-X1:POKEV+3,S(3)-Y1
84 POKEV+30,0:GOTO 55
85 FORI=0TO2STEP2:POKEV+I,160:POKEV+I+1,120:S(I)=160:S(I+1)=120:
   NEXT:RETURN
90 POKE54296,15
91 FORI=1TO75:NEXT:POKE54296,0:RETURN
95 X1=4*RND(0)-2
100 IFABS(X1)<.6THEN95
105 Y1=4*RND(0)-2
110 IFABS(Y1)<.6THEN105
115 RETURN
120 X2=2*RND(0)-1
125 IFABS(X1)<.6THEN120
130 Y2=2*RND(0)-1
135 IFABS(Y1)<.6THEN130
140 RETURN
150 IFS(1)<60THENS(1)=60
155 IFS(1)>200THENS(1)=200
160 IFS(0)>240THENS(0)=240
165 IFS(0)<20THENS(0)=20
170 RETURN
1000 DATA 255,255,255,128,0,1,128,0,1
1005 DATA 128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1
1010 DATA 128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1
1011 DATA128,0,1,128,0,1,255,255,255
1015 DATA 0,0,0,0,0,0,0,0,0
1020 DATA 0,0,0,0,0,0,0,0,0
1025 DATA 0,0,0,0,0,0,0,0,0
1030 DATA 0,0,0,0,0,0,0,0,0
1035 DATA 0,0,12,0,0,12,0,0,0,0
1040 DATA 0,0,0,0,0,0,0,0,0
1045 DATA 0,0,0,0,0,0,0,0,0
1050 DATA 0,0,0,0,0,0,0,0,0
1055 DATA 0,0,0,0,0,0,0,0,0
1065 DATA 0,0,0,0,0,0,0,0,0
```

Line 62 is the main loop that moves all eight sprites.

Line 63 changes their polar coordinate position.

Line 65 updates the horizontal coordinate.

Line 70 updates the vertical coordinate.

Line 71 tells the 64 the new positions.

Line 75 continues with the loop.

Line 80 goes back to the beginning of the loop.

Line 85 is the subroutine that centers all the sprites on top of each other.

Lines 1000-1015 contain all the data required for the shape of a circle.

Listing 5

Line 5 reserves variable space for two sprites, each with a horizontal and vertical location.

Line 8 programs the 64 to play a tone.

Line 9 programs the 64 for a tone frequency.

Line 10 sets the 64 up with a green border and black background.

Line 15 clears the screen and changes the character color.

Line 20 is the start of the sprite registers.

Line 21 turns off all sprites.

Line 25 defines the start of the sprite data table in memory.

Line 31 expands the first two sprites.

Line 35 tells the 64 where the sprite data table is for sprite0 and sprite1.

Line 40 programs the sprite to a purple box and light green ball.

Line 45 puts the sprites in the middle of the screen.

Line 46 turns the sprites on.

Line 50 defines the shape of both sprites.

Line 55 chooses a random velocity for both box and ball.

Lines 60-70 move the sprites.

Line 73 checks if the box has reached one of the edges of the screen; this limits the movement of the box to within a predefined area.

Line 75 checks for a collision; if the two sprites haven't collided, the program continues to move them.

Line 76 causes a beep to be emitted, and the box to be put back to its original location if they have collided.

Line 77 puts the ball back to its original location.

Line 84 resets the sprite collision register to an "uncollided" state and goes back to choosing a new velocity for both box and ball.

Line 85 positions the box and ball in the middle of the screen.

Line 90 is a subroutine which emits a beep by turning the volume on.

Line 91 after waiting a little while, turns the volume off and returns to the main flow of the program.

Lines 95-140 are two subroutines used in choosing a velocity for the box and ball; the program checks if the velocity is too slow, and chooses another if it is.

Lines 1000-1011 contain the data for the box.

Lines 1015-1065 contain the data for the ball. □

"Before you get down to basic, take out the garbage."

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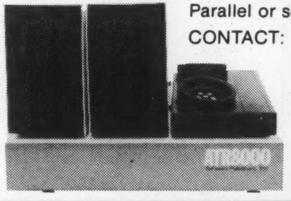

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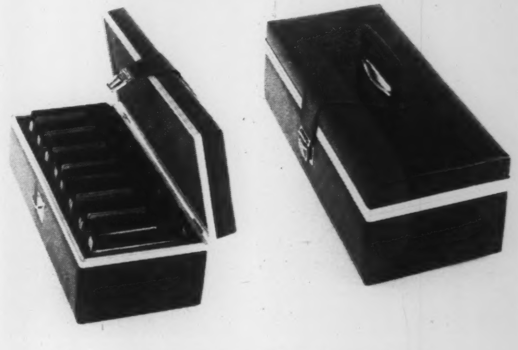

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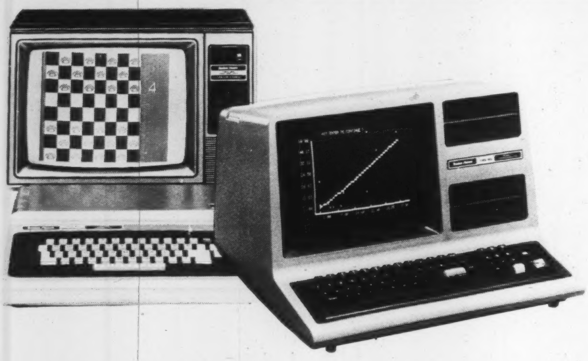

rings...trs-80 strings...trs-8

At the 47th rising of the TRS-80 moon, we look out over the frosty landscape and catch sight of some comments on high-resolution graphics and hard disk drives, find out how to restore the silvery shine of our keyboard surrounds, and examine the word/graphics *CopyArt* processor and a short program that determines the day of any given date.

High Resolution

High-resolution graphics for the Model III was first mentioned in the September 1982 column (p. 211), after I'd heard in London that it was forthcoming from Fort Worth. The second mention was in the October 1982 column (p. 284), in which I described the Mikeeangelo Graphic System ($369 for up to 512 x 192 pixels; recently renamed Mikeegraphic and reduced to $340), and Micro-Lab's Grafyx Solution ($299.95 for up to 512 x 192 pixels), and said readers might want to wait for Radio Shack's offering.

Last September, Radio Shack's new RSC-8 catalog included several new products, among them high-resolution graphics for the Model III, at $369.95 (plus installation) for 640 x 240 pixels (Figure 1). That comes out to about 85.33 pixels per inch horizontally, 36.23 per inch vertically, which does indeed sound like it could provide what the catalog calls "amazingly fine detail," for "sophisticated business graphs, tables, charts, maps, illustrations, geometric patterns—and animation!"

Stephen B. Gray

The package includes a 32K RAM board, manual and diskette with Graphics Basic and a library of assembly language subroutines. The Graphics Basic includes commands for drawing a circle, arc or ellipse; drawing a line between points; shading an area in one of several available patterns; turning an individual pixel on or off (with PRESET); putting the bit-pattern contents of an array onto the screen (useful for animation); and turning the graphics screen on or off.

The RSC-8 catalog says the Model III hi-res graphics package is "available 12/30/82." Mebbe. Anyway, it offers almost 55,300 more pixels than either Mikeegraphic or Grafyx Solution, for $30 more than the first, and $70 more than the second. However, let's wait to see how the Radio Shack hi-res software compares. Byron Mumford's *Rescom* (Oct. 1982, p. 286) has 14 commands for Mikeegraphic; and the software supplied with Grafyx Solution looks even better, with just about every one of the Radio Shack Graphics Basic commands, plus some others that Fort Worth doesn't seem to have included: complement every point on the hi-res screen for an inverse display; draw a box whose diagonal's ends are at two given points; and copy the contents of the hi-res and text screen to a printer with graphics capabilities. (However, it may be possible to create an inverse display by using the POINT and PRESET commands). We'll see, as soon as I can get the Radio Shack hi-res graphics board installed in my Model III.

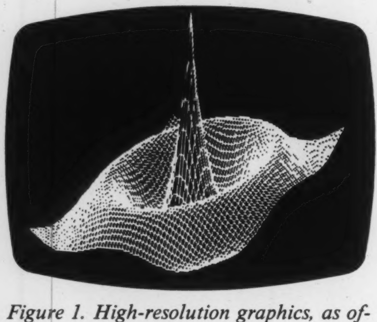

Figure 1. High-resolution graphics, as offered for the Model III TRS-80, provides 153,600 pixels for fine detail.

Note that the high resolution (640 x 240) provides exactly five times as many pixels in both the horizontal and vertical directions as does the standard resolution (128 x 48). Which would mean, if the hi-res graphics area is the same rectangular shape, with the same aspect ratio, 3:7, but only a fifth as large. However, looking very closely at Figure 1, you can see that the pixels are almost square (rounded, in the photo), which makes graphics easier to create. And one of Radio Shack's software people confirms that the hi-res pixel is indeed almost square, with a 4:5 aspect ratio. How come? Well, he says the hi-res graphics area may be bigger than the lo-res graphics area. We'll check that out later, after acquiring a hi-res board.

The 153,000 pixels take 153,000 bits of memory to store. If Radio Shack uses a 32K graphics memory board, that means it provides 32,000 times 8 bits, or 256,000 bits, which means there are 102,400 unused bits on that board. So why not put only 20K, or 160,000 bits of RAM memory, on the graphics board? According to a Radio Shack source, it may simply be more economical "to use the chips we chose," which must mean

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they need stock only one size of RAM chip, perhaps a 64K chip, for the hi-res board. Somebody will undoubtedly find a way to use the 102,400 idle RAM bits.

The graphics memory, by the way, is independent, and can overlay text in the regular video memory, so graphics and text can be combined in one display.

The assembly language subroutines are there only if and when you want to use the graphics commands from a language other than Basic, such as Fortran or Cobol. If you use only Basic, you'll never need those subroutines.

Hard Disk Drive for Models I and III

Forecasting some Radio Shack products isn't all that difficult After all, the RSC-7 catalog included hi-res graphics for the Model II, with exactly the same resolution and Graphics Basic commands as for what was to come later for the Model III (but at $499).

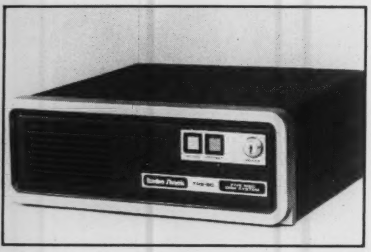

Figure 2. The hard-disk drive for the TRS-80 Model III or I TRS-80 adds 5 megabytes of storage.

It was only a matter of time before Radio Shack offered such a highly desirable item as hi-res graphics for the Model III. The RSC-6 catalog offered a hard disk system for Models II and 16 with 8.4 megabytes of storage for $4495. Again, it was only a matter of time before a similar hard disk system was available for the Model III; the RSC-8 catalog has it, for the III (and I, with an adapter), at $2495 for 5 megabytes of storage (Figure 2). I had known quite some time before this writing that Radio Shack had ordered hard disk drives for the Model III (no, I didn't get the information from Fort Worth), but there was no point saying anything before now, because Radio Shack has enough problems without people calling up to ask when the hard disk drives are coming. The RSC-8 catalog gives all the details, plus an availability date of 11/15/82.

Incidentally, those prices for the hard disk drives are for the primary drives, which include a hard disk operating system. The secondary drives are less ($3485 for the II, $1995 for the III); up to four hard disk drives can be attached to a Model I, II, III, or 16 TRS-80, for a total of 20 or over 30 megabytes of storage, depending on the model.

Why use a hard disk (also called a Winchester) system? You can eliminate most, if not all, of the tiresome business of having to put one floppy disk after another into your drives (except when it comes to backup disks). This may not be a big deal if you are a hobbyist, but for a business with many records, hard disks save a lot of time, not only because most floppy disk programs and data can be transferred to hard disk, but because they are then available much, much faster. On the Model II floppy disk drive, for example, the transfer rate is 500 kilobits per second. The Model II hard disk transfer rate is 4.34 megabits per second, providing what the catalog calls "extremely fast access to programs and data."

Aluminum Sprayed on Plastic II

The problem of the aluminum paint wearing off the keyboard of your TRS-80 if you rest your hands on it too much was mentioned in June 1982 (p. 217). The question was asked, "Has anybody found a spray-on or brush-on paint that matches the TRS-80's aluminum color?"

Michael B. Rowe, P.E., of Simplified Software Systems, which sells computers, accessories and software out of Hickory, NC, wrote:

"In one of your recent columns, you addressed the problem of the paint being rubbed off the TRS-80. Being in the software business, we use our machines constantly, and as a result we had the same problem. Our solution was arrived at by buying several different brands of aerosol-type aluminum sprays, and using molded-plastic outlet boxes for tests. What we decided on proved to be a satisfactory color match, and probably a better finish than the original. The procedure requires that you follow these steps carefully.

1. If the computer is out of warranty, remove the aluminum shell from the keyboard—or, in the case of the Model III, the whole top—as a unit. *Caution*: Be extremely careful when removing the top from the III to be sure you do not damage the neck of the CRT.

2. Use extra-fine (220 to 600 grit) sandpaper to slightly roughen the surface to be coated. Carefully remove all sanding dust!

3. Apply Krylon, Dull Aluminum 1403, to the area to be coated, in several light coats rather than one heavy coat. It dries quite rapidly, so only 20 to 30 seconds is required between these light coats.

4. After the dull aluminum spray has dried for several minutes—preferably not more than four or five—apply several light coats of K-Mart brand Fast-Drying Spray Enamel in CLEAR U3733. This may result in slightly more surface sheen than the original, but generally blends nicely. On our Model IIIs we did not have to paint the whole top to get a satisfactory appearance.

"I might add that the black plastic keyboard bezel on both the I and III can be removed and recoated if necessary (someone got white paint on one of ours), using Martin-Senour Vinyl Color Spray #7977, Jet Black. Note that is Jet black, not Gloss black.

Before trying this on your TRS-80, you might want to work up a good spraying technique (slow and steady) on some scrap plastic or whatever. If you try the above solution, or have others, please let us know.

CopyArt Word/Graphics Processor

According to the ads, *CopyArt* provides "the new dimension in word processing," which is graphics; you can put words and pictures on the same screen or page (Figure 3). That is, if you have a Model I or III TRS-80, 48K of memory, and at least one disk. And *CopyArt*, which is $149.95 from Simutek Computer Products Inc. (4877 E. Speedway, Tucson, AZ 85712).

CopyArt combines a word processor very much like Radio Shack's *Scripsit*, a graphics mode for using the cursor like a pen, drawing lines with the four directional arrows (similar to Etch-A-Sketch); a second graphics mode that creates large-size letters and numbers; and extensive printout capabilities. *CopyArt* was written with a special version of Simutek's ZBasic compiler, which is advertised as "the world's fastest TRS-80 Basic compiler," and which will be reviewed here at a later date.

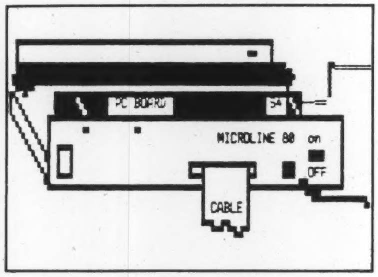

Figure 3. This partial illustration from the CopyArt *manual, showing how to set up an Okidata Microline printer, was created with* CopyArt.

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CopyArt Word Processing

If you have used *Scripsit, CopyArt's* word processing capabilities will be very familiar. Some are just about the same, many are new or improved, and only a couple are not quite as good as their *Scripsit* counterparts.

As in *Scripsit,* you use CN=Y for centering, JU=Y for justifying text, LM=5 for left margin at 5, RM=65 for right margin at 65, HD=2 for using the next two lines as headings, PG=10 for starting page numbers on page 10, etc. As in *Scripsit,* you can scroll text (roll the screen up or down the text), move to the top or bottom of text (or to the left or right side of text) using combinations of arrow keys and the shift key, and do global search and replace.

Moving text around is simpler: you just put any text to be moved into a buffer, move the cursor to a new position, and unload the buffer, which places the text in the new position. With the down-arrow, you can move down a screenful at a time, instead of just a line at a time.

To emphasize text, you can simply put SE=Y in the format line (for single emphasis), which double-prints a line and thus makes it darker, or use DE=Y (for double emphasis), which will quadruple-print a line and make it extra dark. To underline text, simply put a ± at the beginning and end of phrases you want underlined.

Two of the best *CopyArt* word processing features are for deleting or inserting characters, and operate more as they do in commercial word processors. Press D, and everything to the right of the cursor moves to the left and disappears, as though swallowed up by the cursor. Press I, and blank spaces pour from the right side of the cursor.

A Directory feature calls up a menu allowing you to get a listing of all the various files on as many as four disk drives, or find out how much space you have left on a diskette.

Hitting the H key calls up help: four pages of display listing the various commands for word processing and printer format, plus some tips. As the manual puts it, "To help you remember the various commands we've included a reference cards." On the screen, that is. Fine, but I would still like a separate card, rather than having to call Help every time I need a simple assist. For me, the lack of a reference card is the only serious problem with *CopyArt.* The index to the 104-page manual is quite good, but using a manual to look up commands takes too much time.

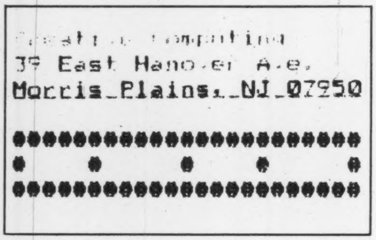
The only *CopyArt* commands that seem to work better in *Scripsit* are two of the simplest: cursor movements left and right, which don't operate as smoothly. Generally speaking, *Scripsit* seems more professional and tidier in operation than *CopyArt.*

CopyArt Line Graphics

Hit the break key and then G, and you are into graphics mode. Now you can use the cursor like a pen (or an eraser), drawing lines (or deleting them). Hit D, and as you move the cursor with the arrow keys, it leaves a trail. Use E to get into erase mode. By switching back and forth from D to E, you create graphics. To move the cursor around without drawing or erasing anything, use M. To speed up the cursor, hit F. That's all there is to the draw-a-line graphics, but you can do a great deal with these four commands.

CopyArt Character Graphics

Hit @ and Y, and you can create big graphic characters automatically, for headlines or banners or whatever you need. The *CopyArt* disk includes a basic set of characters, including the alphabet and numerals, which you can display and print out in various sizes.


[illegible]
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Morris_Plains,_NJ_07950

Figure 4. CopyArt *can print with varying degrees of emphasis, underline, and can approximate graphics blocks with 0 over #.*

After you hit Y, you type in a letter, word or phrase at the bottom of the screen. You specify the height and width of the characters, whether you want them printed horizontally or vertically, and in black on white or inverted (white on black).

These characters can be printed out quite large, especially vertically, where you can print fairly long banners. If you have a printer—such as the Okidata Microline or Epson—that supports the TRS-80 graphics character set, then your banners will be printed with letters of solid black.

On other printers, *CopyArt* uses "pseudo-graphics," by printing, instead of a solid black rectangle (which is equivalent to a white rectangle on the screen), a # overprinted by a 0.

Although at this moment I have three printers on hand, not one of them can print a graphics block. So I had to use pseudo-graphics to see what *CopyArt* can do. In the first example (Figure 4), I put a row of pigeonholes below *Creative's* address, with the first line printed normally, the second with single emphasis (printed twice), and the third using double emphasis (printed four times) and underlined. Although the four boxes were exactly the same size in the original, the printout is a pseudo-graphics approximation, with two sizes of boxes.

The second example (Figure 5) shows

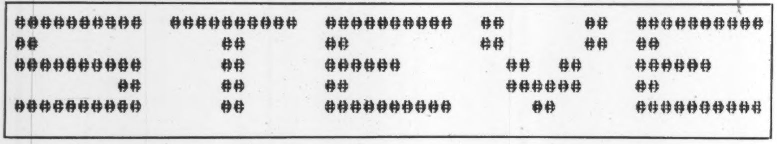


Figure 5. Using pseudo-graphics, CopyArt *can print a good approximation of solid letters.*

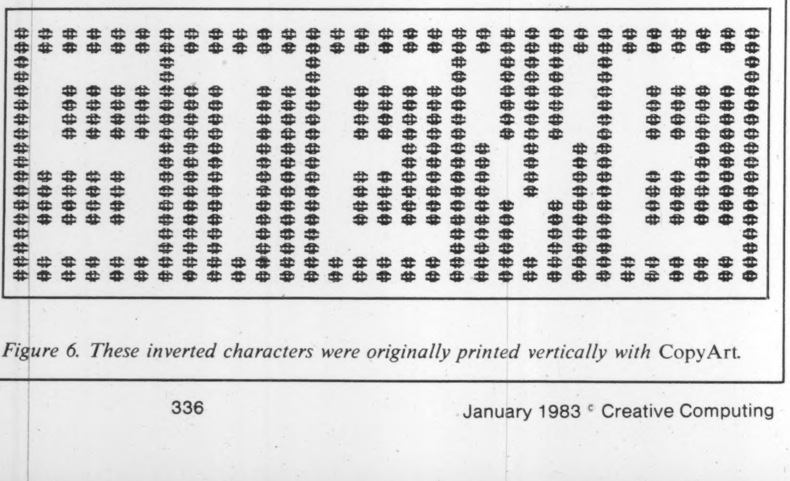


Figure 6. These inverted characters were originally printed vertically with CopyArt.

TRS-80 Strings, continued...

my first name printed horizontally with small pseudo-graphic characters. The third example (Figure 6), shown horizontally, was originally printed vertically and inversely.

Actually, in that last example, three sets of the name were printed vertically. You can put a word on the screen, then move it over to the right using the insert command to insert blanks, then put another word on the screen, push that into the middle, and add a third word alongside. Incidentally, as the manual notes, the *CopyArt* graphic characters are meant to be used as a framework; you can use the graphics mode to change the basic letters into almost any style you want. "For example, once you have the characters on the screen, you might patch them so they look a little more like Old English type.

Advanced CopyArt

The imaginative manual has a section on some fancy features, such as killing the linefeed for creating new characters with overstrikes, turning off printing so as to print only a portion of a document, using *CopyArt* as an editor, and, if your printer uses special control codes, inserting them directly into text.

When you want to use a control code, you hit @ and C. A message appears at the bottom of the screen:

Cntrl codes?

At which point you simply enter the code. The Cetnronics 737, for example, will start underlining if it is given control code 14. So you type 14, and hit the enter key. Depending on the printer and the code, a character (sometimes a rather strange one not in the regular set) may or may not appear on the screen. It won't be printed out, but will affect the text following it.

```
10 CLS: DIM N(12)
13 FOR X=1 TO 12: READ N(X): NEXT
15 FOR X=0 TO 6: READ D$(X): NEXT
20 INPUT "ENTER MONTH,DAY,YEAR (MM,DD,YY) ";M,D,Y
25 Y1=Y
27 IF Y/4=INT(Y/4) THEN 29 ELSE Y=Y-1: GOTO 27
29 Y=Y/4
30 T=Y+Y1+N(M)+D
32 T1=FIX(T/7): T2=T-(T1*7): IF Y1=00 THEN 50
40 IF Y1/4=INT(Y1/4) AND M=1 THEN T2=T2-1 ELSE
   IF Y1/4=INT(Y1/4) AND M=2 THEN T2=T2-1
50 REM CHANGE THIS LINE FOR 1800'S AND 2000'S
60 PRINT "THE DAY IS: "; D$(T2);".": PRINT
70 T=0: GOTO 20
100 DATA 1,4,4,0,2,5,0,3,6,1,4,6
110 DATA SAT,SUN,MON,TUE,WED,THU,FRI
```

That's most of the *CopyArt* features, which are many and varied, and which you can take days or weeks exploring before you find out all the program can do. (It can simulate a page up to 255 characters wide, for one thing.) If the price seems high, consider that Radio Shack's *Scripsit* alone is $99.95; for an extra $50 you get a word processor with many features not found in *Scripsit*, plus a graphics generator with a great many fascinating capabilities. If you want to combine words and pictures, *CopyArt* provides what may well be the only way to do it directly.

Short Program #35: Calendar

Max Seim of Stillwater, MN wrote to say he "recently picked up the latest issue of *Omni* magazine and quickly flipped to my favorite section: Games."

"I was very interested in the unique mathematical way they showed to determine the day of any given date. I decided to use this method to produce what I think is the shortest Basic program ever written that does it.

"*Note:* The data are important and must be correct. These twelve numbers are the key numbers for each month used in the formula in lines 29-32. That's the complete listing . . .all nine lines of it!"

The program as it sits will determine the day during the 1900's only. Line 50 must be changed for the 1800's and 2000's:

For the 1800's: 50 T2=T2+2

For the 2000's: 50 T2=T2-1

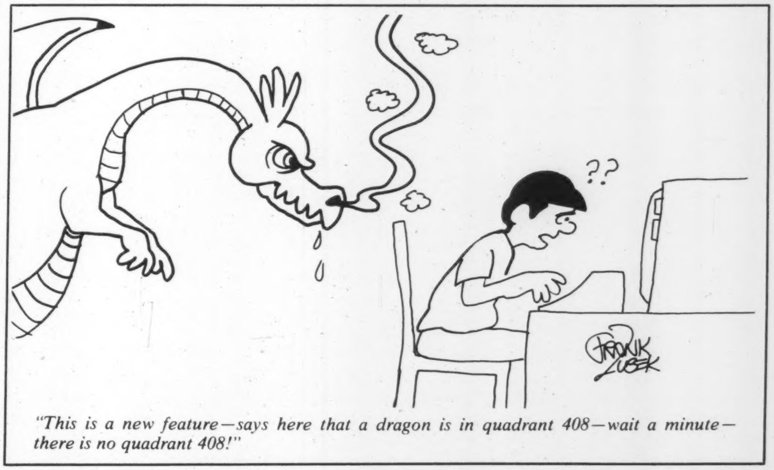
"The program could be easily modified to make these adjustments automatically. Simply input the year as four digits instead of two."

"1900 and 1800, although divisible by four, are not leap years. The program allows for this in the last part of line 32. Years such as 2000 and 4000 are leap years because they are divisible by 400. If you wish to input the year 2000, make sure the last part of line 32 is removed. The last part of line 32 simply jumps over the leap-year determiner if you input 00 for the year.

"If you have any questions, see pages 152-3 of the November 1981 *Omni* magazine."

Max's original program (which of course he submitted some time ago) did contain only nine lines, but I stretched it out a little to make it more readable and to fit this column.

The calendar item Max refers to in *Omni* is called "You too can be an idiot savant," and tells how, by memorizing a method and certain numbers, including those in DATA line 100, you can amaze people by giving the day for any particular date, with just a few moments of mental calculation. The method is fairly simple, but you'd have to use it quite often to be able to remember it for any length of time. □



"This is a new feature—says here that a dragon is in quadrant 408—wait a minute—there is no quadrant 408!"

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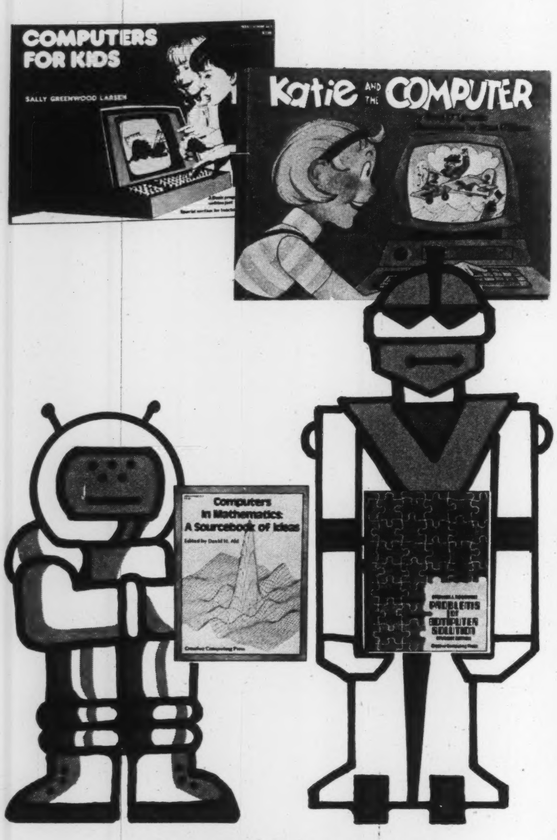

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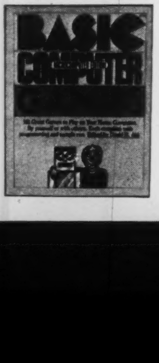

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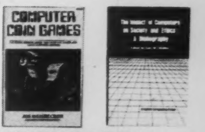

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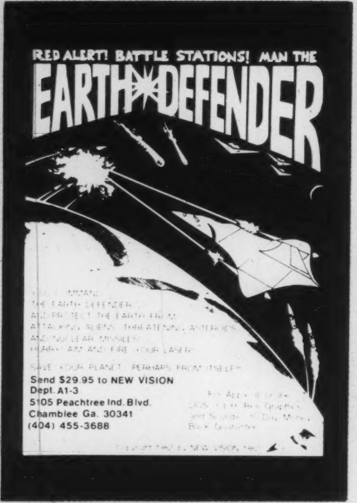
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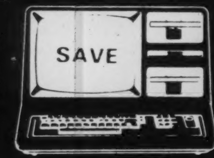

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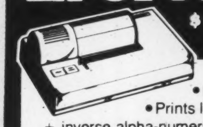

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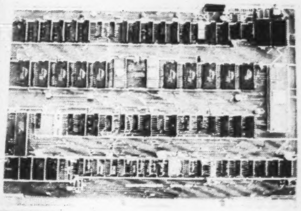

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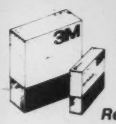

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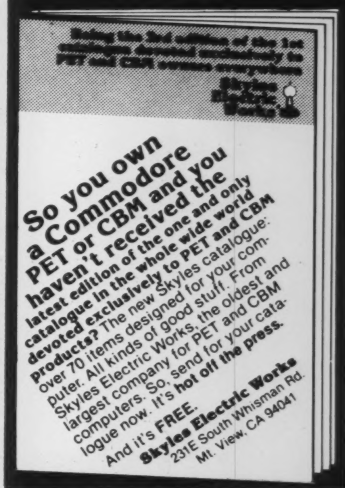

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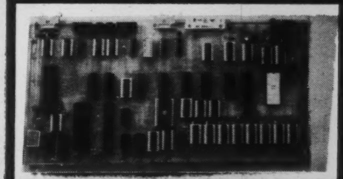

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101	Aardvark Technical Services	185
307	Abacus Data	310
102	ABC Data Products	208
*	Accent Software	88
103	Adventure International	122
104	ALF Products	26
105	Alpha Btye Computer Products	41
109	Alpine Software	193
106	Alternative Software	151
107	Amdek Corporation	31
108	American Small Business Computers	55
110	Anthro Digital	299
111	Apple. Computer, Inc.	96-97
112	Appleware, Inc.	240
300	Applied Software Technology	218
113	Archive	229
114	Ark Computing	221
*	Artworx	145
*	Aspen Software	233
117	Automated Simulations	121
198	Automated Simulations	198
116	Avalon Hill Game Company	72
312	B.A.S.F. Computer	149
118	Beagle Brothers Micro Software	174-175
251	Big Five Software	13
*	Bottom Line	207
120	BPI Systems	194
121	Brain Bank	240
122	Broderbund Software	140-141
123	BT Enterprises	182
124	Business Machine Consultants	286
119	Cab-Tek	301
126	California Accessory Warehouse	251
127	Calsoft	239
130	Charles Mann & Associates	254
314	Checkmate	286
131	Chrislin Industries, Inc.	255
132	Chromasette Magazine	288
133	C-Load Magazine	289
134	Collins International Trade Corp.	133
135	Commodore Business Machines	Cov 3
136	CompuServe	197
137	CompuShack	200-201
138	Computer Discount of America	45
139	Computer Discount Products	245
304	The Computer Entrepreneur Publishing Company	291
140	Computer Exchange	52-53
141	Computer Mail Order East/West	124-125
142	Computer Outlet	276-277
143	Computer Plus	263
144	Computertime, Inc	297
145	Computerworld International, Inc.	177
146	Computronics	5
147	Comstar	106
148	Consumer Computer	297
149	Control Data	80-83
150	Corona Data	2
151	Cosmic Computers Unlimited	20
152	Cottage Software	232
153	CPU Shop	243
154	Creativity Unlimited	286
155	Dakin 5	11
156	Datamost	90
157	Datamost	91
170	Datamost	92
158	Datamost	93
159	Dickens Data Systems	26
*	Digital Equipment Corporation	18-19
162	Discount Data Products	264-265
181	Don't Ask Computer Software	74
164	D/Punch Company	285
165	Dresselhaus Computer Products	55
166	Dynacomp	256-257
167	Electronic Specialists, Inc.	299
168	Epson America	76-77
169	Excalibur Technologies Corporation	205
171	First Star Software	71
172	First Star Software	73
173	First Star Software	75
174	Floppy Disk Services	137
196	Franklin Computer	38
175	Gamestar	58
177	Genie Computer Corporation	134-135
176	Gladstone Electronics	294
178	Gold Disk Software	172
179	Great Plains Software	127
180	Happy Hands	45
*	Hayden Software	107
182	Howard Sams Co.	130
183	Huntington Computing	241
184	IBM Corporation	56-57
185	IJG Computer	48
186	IJG Computer	131
*	Infocom	170-171
187	International Software Marketing	164
188	I/O Management	301
189	Jade Computer Products	211-213
310	Kelly's Computing	228
190	Kensington Microware	155
191	Kensington Microware	157
301	Kern Publications	230
192	Leading Edge	9
199	Leading Edge	Cov 4
193	Learning Tools, Inc.	280
194	Lifeboat Associates	190-191
195	Little, Brown and Company	263
197	LNW Research	23
115	LNW Research	60
200	Lyco Computer	313
*	Macmillan Book Club	99-101
201	Meridian	84
202	Micro Business World	304
203	Micro D	27
204	Microhouse	28-29
215	Micro Lab	62
205	Micro Learningware	285
206	Micro Management Systems	335
207	Micro Mountain	227
208	Microsoft	128
210	Micro Systems Software	333
209	Microsystems Exchange	287
211	Microware Distributors, Inc.	235
212	Micro Works	300
213	Milliken Publishing	143
*	Mind Systems	325
214	MTG Technical Sales	223
303	Muse Software	269
216	NEBS Computer Forms	278
217	Nexa Corporation	299
*	NRI Schools	165-167
218	Odesta	70
219	Omega Microware	247
*	Omega Sales	147
221	Omni Resources	189
222	Optimized Systems	63
223	Optomam Consumer Products	45
224	Orange Micro	219
225	Orbyte Software	299
226	Pacific Exchanges	285
226	Pacific Exchanges	286
226	Pacific Exchanges	294
227	Pacific Polytech	232
228	Pan American Electronics	286
229	Parthenon Computer Corporation	152
230	Pathway Software	278
231	Peachtree Software	66-67
232	Penguin Software	44
233	Peripherals Unlimited	283
234	Perry Oil & Gas	263
235	The Personal Computer Show	263
236	Practical Peripherals	Cov 2-1
237	Programmer's Institute	231
238	Protecto Enterprizes	209
239	Psychological Systems	301
240	Quadram Corporation	186
241	Quality Software	139
*	Qume	160
242	Qume	161
243	Radio Shack	163
244	Ranco Software Games	231
246	Reader's Digest Services	105
247	Red Baron	181
298	RH Electronics	108
299	R.H. Electronics	109
249	Royal Software	309
250	Royal Software	114
245	R & R Software	89
305	Savvy	51
308	SFA	286
253	Sierra On-Line, Inc.	37
252	Sierra On-Line, Inc.	69
254	Sierra On-Line, Inc.	159
255	Silicon Valley	85
256	Silicon Valley	87
257	Sirius Software	15
258	SJB Distributors	217
316	Soft Images	111
317	Soft Images	113
259	Soft Images	115
319	Soft Images	117
260	Software City, Inc.	252
261	Software Dimensions	178
263	Softwareland, Inc.	244
264	Software Models	297
265	Software Productions	284
266	Software Publishers	331
267	Software Publishing	34-35
269	Southern California Research	253
*	Spinnaker Software	16-17
270	SSI	79
271	Star Micronics	42
340	Strategic Simulations	169
272	Strategic Simulations	47
274	Strictly Software	225
275	Sublogic	14
276	Synapse Software	103
277	Systems 4 Limited	237
278	Tech Data Corporation	287
352	Tecmar	7
279	Trace	65
280	Unique Software	331
281	Valley Sof'Touch	242
306	Val Par International	25
302	Vectrix Corporation	118
284	Videx	61
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311	WICO	249
287	Yacaipa Software	297
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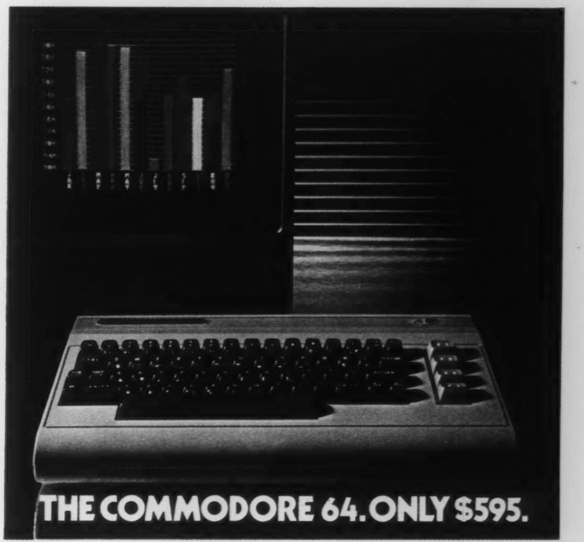

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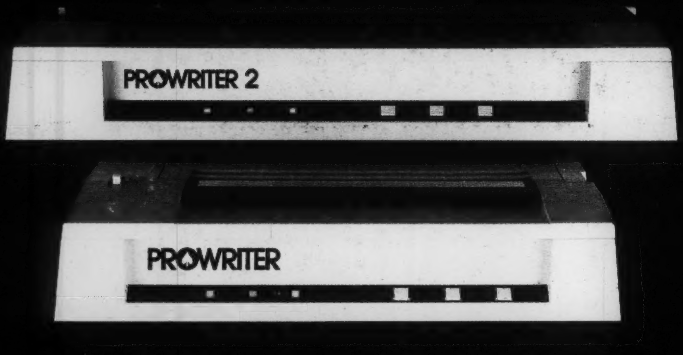

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